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CLASSIC WARBIRDS

Merlin PR Spitfires



Operational history
Camouflage colours
RAF squadrons
USAAF in Europe
Captured Luftwaffe
Post-war operators

Classic Warbirds No.10

– Wojtek Matusiak –

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No.10

– Merlin PR Spitfires –

by Wojtek Matusiak



A pink Spitfire PR.VII, probably P7505. Note the camera sighting markings on the distinctive canopy teardrop blisters. The purpose of the small window in the fuel tank cover, forward of the windscreen is not known. It appears on most early Mk IIs and P7505 was the only PR.VII converted from a Mk II. (P. Arnold)

No.10 in the Classic Warbirds series

INTRODUCTION

The book describes a little known but important chapter in the history of Spitfire: the Merlin-engine Photo Reconnaissance variants. Coverage includes: development, wartime use by the RAF, USAAF and Soviet AF, camouflage & markings, plus post war operators around the world.

Spitfire is often seen as *the* fighter. Many people consider it the most beautiful or the best fighter of WWII. The former is a matter of individual opinion (personally, we agree!), the latter would be difficult to prove.

Anyway, reconnaissance versions of this famous aircraft have always been overshadowed by the glamorous idea of a nimble machine actually Spitting Fire. And yet, while the 'most important fighter of the conflict' label would be seen by many as an exaggeration, there can be little

doubt that Spitfire was *the* most important photo-reconnaissance aeroplane of WWII.

It is therefore a pity that many popular histories of the type focus on the dogfights and aces, neglecting the 'unarmed, unafraid & unaccompanied' heroes. Those authors who dare get to grips with the subject face confusing information on the multitude of versions, aggravated by their varying designations. This work is no exception to this rule. The (dis)order of the chapters testifies best to it. Individual variants are not presented here chronologically from the earliest to the latest, nor in the alphanumeric order. I tried to stress the evolution of individual branches of the whole family of photo-recce Spitfires and show the main directions of their development, since, in fact, the basic concepts of aerial photo reconnaissance developed in those days have not changed until present times.

1996 was the year of the Spitfire's 60th anniversary and the warbird would be sorely missed if it did not appear during the Polish air show season. Indeed! Spitfire PR.XI PL965 arrived at the Warsaw Airport on the evening of 29 May, the first Spitfire in history to appear at an air show in Warsaw.

...May 29 is my birthday and I couldn't imagine a more special present!

Wojtek Matusiak

This tenth book in the Classic Warbirds series was written by Wojtek Matusiak.

Additional material was provided by Kenneth O Buhl on Danish PR.XIs, Stein Meum and Tom Arheim on Norwegian PR.XIs, and Paul Ludwig on USAAF Spitfires. Thanks go to Rex Barker, Judy Laird and Roger Wallsgrove for their proof reading.

Malcolm Laird

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I wish to thank all the other people who contributed their photos and historical knowledge: Peter R. Arnold, Krzysztof Choloniewski, Robert Gretzyngier, Ricardo Lezon, Dr Alfred Price, F/Lt H. J. S. *Jimmy* Taylor and Helmut Terbeck. Last, but certainly not least, I want to thank Malcolm Laird, who started this publication, made it real, and patiently put up with my ideas.

Wojtek Matusiak

FRONT COVER (PHOTO IS "COLOURISED")

Photogenic Virgin of the 7th PG with Lt. Gerald Glaza and his Crew Chief Vernon Grubb. (Paul Ludwig)



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Author.. Wojtek Matusiak

Illustrations.. Malcolm Laird

Cover design.. Judy Laird

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A picture taken on 26 July 1942, in the Main Market Square of Cracow, Poland. In front of the medieval Sukiennice the Germans held an exhibition of captured materiel from all fronts.

There is a wreck of a Bloch MB.152 in the foreground and in the background is a light-coloured Spitfire with the 'LY' codes of the PR Unit. The Spitfire, the first of the type to be shown to the Polish public, is most probably K9791 (see p. 7).

As shown in the opposite page, it would take another 50 years before a flying display by a PR Spitfire was seen in Poland.

(ADM archives)

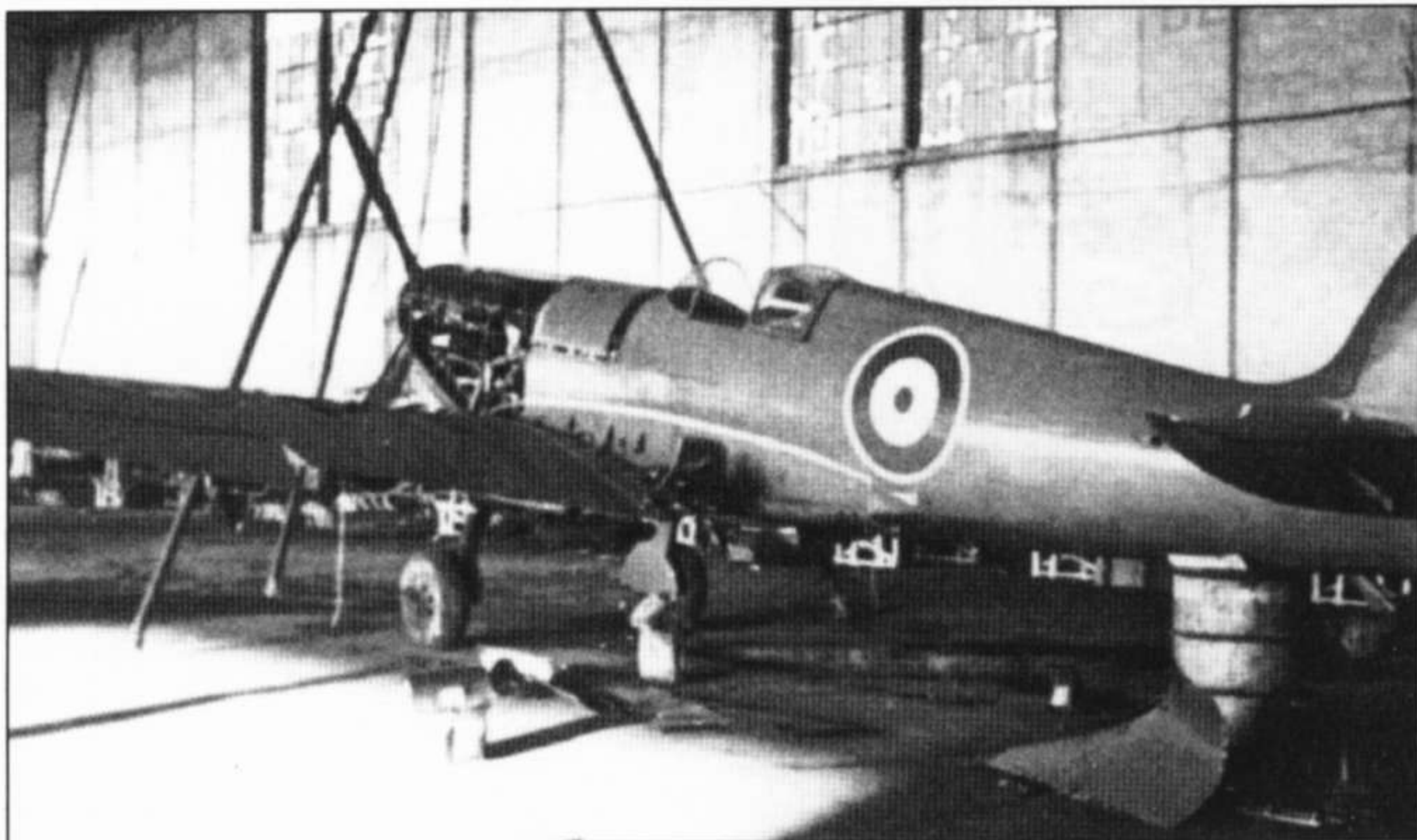


THE COTTON CLUB

FIRST PR CONVERSIONS

The history of reconnaissance Spitfires began in March of 1939, when the so called Heston Flight was formed. The name came from Heston airfield in West London. This was a secret unit dedicated to aerial photographic reconnaissance, reporting to the intelligence services. The initiative to form it came from Wing Commander Frederick Winterbotham - Chief of Air Intelligence in the Secret Intelligence Service. Until that time, Air Intelligence had been about gathering information *about aviation* rather than, *by using aircraft*; Frederick Winterbotham was, in the true sense of the term, a secret agent. Sidney Cotton, an Australian born civilian and a colourful character, became OC of the Flight (or perhaps its boss, being a civilian). Apart from him, the Flight consisted of another pilot, Robert H. Niven¹, a Canadian RAF Flying Officer (officially on leave), plus Patricia Conran, Cotton's secretary. Cotton and Niven travelled around Europe in a twin-engine Lockheed 12A posing as businessmen and, using concealed cameras they took photographs of areas of interest to British intelligence. In their trips they reached the Mediterranean and Cotton stayed at Malta for some time. Among the RAF personnel there was one F/O Maurice V. 'Shorty' Longbottom, who became very interested in Cotton's methods.

In August 1939 Longbottom filed a memorandum 'Photographic Reconnaissance of Enemy Territory in War' to the RAF HQ. The memorandum was inspired by Cotton, but it was Longbottom who presented it as a serving RAF officer. The document proposed to use small, single-engined, fast aircraft (preferably fighter types). These would be adapted for the role by removing unnecessary equipment, including the armament, and increasing the fuel load for maximum range. Longbottom calculated that a recce version of the Spitfire, with no armament and overladen (no manoeuvrability provisions were necessary in the absence of air combat requirements), could carry an extra load of over 920 lbs, equal to two cameras and 240 gallons of fuel. The fuel load was 2.5 times that of the fighter variant. A high maximum speed would protect the Spitfire from enemy interceptors and high altitude would keep it safe from Anti Aircraft fire. By today's standards the ideas presented in Longbottom's memorandum

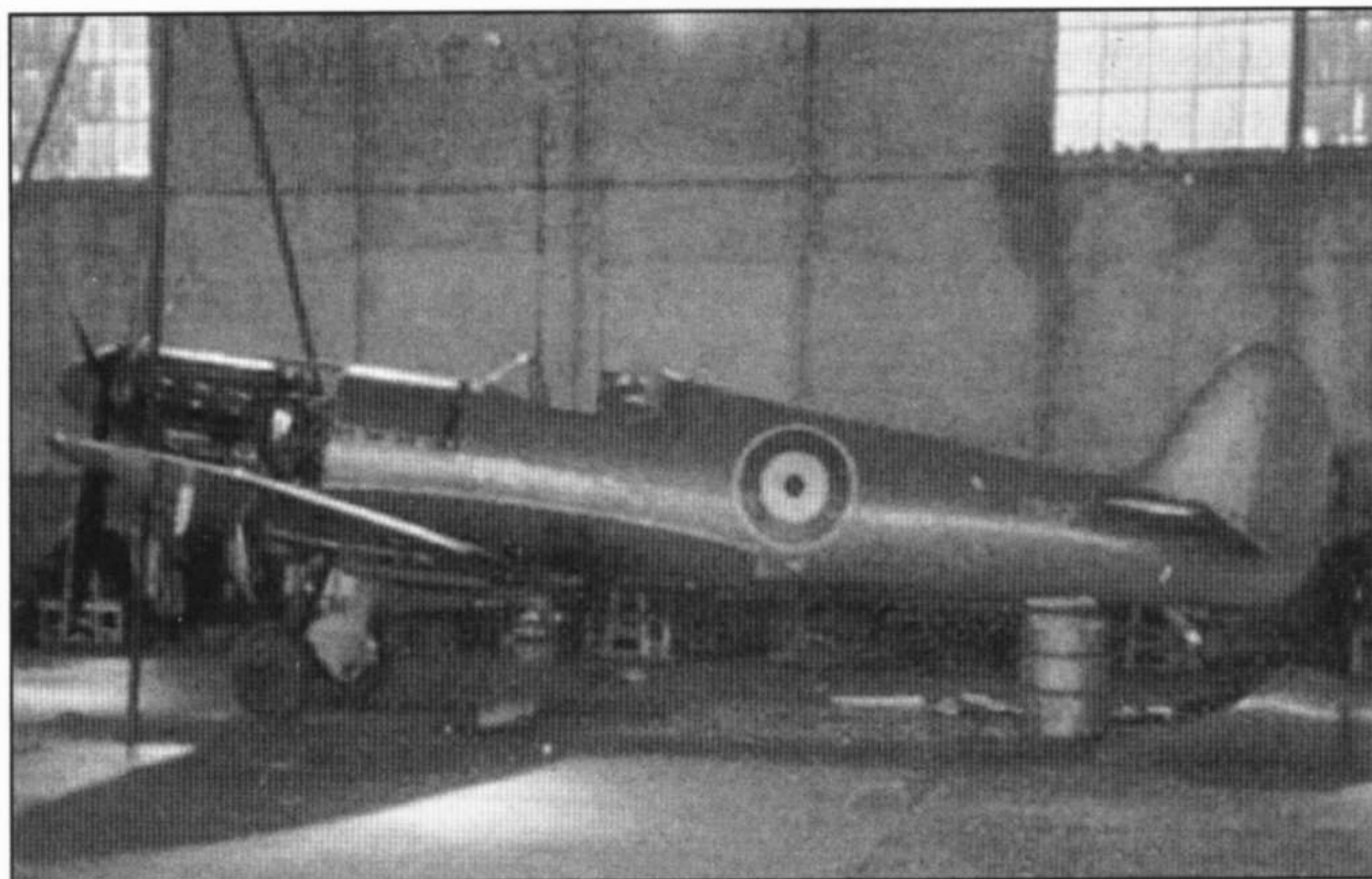


Spitfire PR type B P9331 in a hangar at Reims/Champagne aerodrome in early June 1940. On the afternoon of 7 June F/Lt 'Tug' Wilson was forced to land the machine there during an abortive mission to photograph the railway line Maastricht-Liege. This was the first recce Spitfire captured intact by the Germans.

(via W. Matusiak)

Another picture of Spitfire PR type B P9331. The colour scheme is unknown, with PRU Blue not yet introduced. It could be any shade of blue or grey. There is a light outer ring around the roundel (probably yellow). Also the wing roundel had a similar outline, suggesting blue camouflage shade, which necessitated an outline to clearly separate the roundel from it.

(via M. Payne)



¹ Later Niven returned to regular service in the RAF. In 1940 he failed to return from a routine flight over North Sea in a Bristol Beaufort.

seem pretty obvious, as it is according to these ideas that strategic reconnaissance aircraft have been developed in the half a century that followed. However, at that time the document was a revelation. In those days PR duties were normally carried out by large, slow, heavily armed aircraft with large crews.

PR SPITFIRE TYPE A

After war broke out Cotton the 'businessman' could no longer fly over Germany and on September 24 the Heston Flight became a regular RAF unit. Cotton was made an Acting Wing Commander. His requests for Spitfires were denied initially, and it took a personal meeting with Air Chief Marshal Sir Hugh Dowding, AOC-in-C Fighter Command, to obtain two Spitfires.

Two machines, N3069 and N3071, were delivered to Heston on 13 October 1939. In spite of Cotton's and Longbottom's suggestions, Supermarine designers refused to have cameras or fuel tanks installed in the fuselage behind the cockpit. They feared this would shift the centre of gravity too far aft. So, in these two Spitfires, the modifications were limited to installing an F.24 camera with 5" focal length lens, in each wing, replacing the inner machine guns. The cameras were fitted almost vertically, with a slight outward bias to cover a wider area in a single run. The 'fields of view' of the cameras overlapped only slightly.

Work on various camera arrangements was carried out by Harry Stringer of the Royal Aircraft Establishment, Farnborough. To reduce weight the radio was removed, gun ports were faired over and all the panel gaps filled with plaster, painted over, then polished. This first modified Spitfire reached over 390 mph, more than 12 mph faster than a standard fighter. The PR 'type A' ('PR' for Photographic Reconnaissance) designation was only introduced after the second version, the 'type B', appeared.

The 'type A' featured a standard fighter-type windscreen with armoured glass and a canopy with tear-drop bubbles² on both sides, to improve down and backward visibility. The aircraft were painted a light blue-green colour called 'Camotint Green'. The colour's story is typical of Cotton's activities. After he saw an aeroplane of an Indian Maharaja painted this colour disappear in the sky quicker than others, he realised the colour was a useful

camouflage tint. He soon ordered a quantity of paint in this colour and registered it for himself under the name 'Camotint' (short for camouflage tint). The name Camotint was later used for all non-standard colours used on Heston Flight aircraft. This original Camotint Green was a shade similar to the ones listed in British Standards colour guides under the poetic names of Sky (not to be confused with the Sky Blue!) and Eau-de-Nil (*Water of the Nile* in French). Experiments were also made with gluing paper on all surfaces, but this tended to peel off at panel joints.

To hide the true occupation of the Flight it was officially designated No. 2 Camouflage Unit as of 1 November 1939. This was a reasonable ruse, since there already existed a No. 1 Camouflage Unit that really did develop new painting schemes and the PR aircraft bore various colour patterns which rarely conformed to current RAF regulations. The appropriate regulations³ stated that '*...Aircraft of photographic reconnaissance units are to be coloured and marked in accordance with operational requirements, and the colour scheme need not conform to the standard system*'.

On 18 November 1939 Longbottom, now promoted to Flight Lieutenant, flew the first operational PR Spitfire sortie in N3071. He took off from Seclin airfield near Lille in France (on the Belgian border) where N3071 had been sent as part of the so called Special Survey Flight which arrived in France on 5 November. Regrettably, this historic mission was a complete failure, mainly due to bad weather. Instead of the city of Aachen, photos showed an area on the Belgian side of the border, well to the south-west. The first successful mission was flown four days later when German-Belgian border fortifications at Liege were photographed, albeit again from the Belgian side. Not until 21 December did the Spitfire bring back the first photographs of German territory. At that time N3071 also flew from Essey, near Nancy. The Special Survey Flight ended its activities on 10 January 1940 and N3071 returned to Heston – but not for long.

PR TYPE B

The experience with the first two PR aircraft led to development of an improved variant called PR 'type B' or 'Medium Range' (MR). This received F.24 cameras with 8" focal length lenses to improve

2 At that time standard Spitfires featured cockpit hoods with flat sides. The tear-drop bubbles on canopy sides were one of Cotton's original ideas, developed in May 1939. He even patented them, which entitled him to a royalty of 10 shillings per unit, but he generously waved that. For comparison, a Pilot Officer's daily wages at that time amounted to 12 shillings, plus 2 1/2 shillings flying allowance.

3 First the amendment of March 1940 to the AMO A.520 of December 7, 1939, and then the A.926 of December 12, 1940 (paragraph I.8) and A.513 of July 10, 1941 (paragraph I.3.i.c).

the resolution. A 29 gal (132 l) fuel tank was mounted in the rear fuselage instead of the normal 40 lbs of ballast fitted there normally to counter-balance the three-bladed variable pitch propeller.⁴ This gave an increase in range to over 310 miles. The type B was the first to dispense with the heavy armoured glass windscreen.

On 16 January 1940 Longbottom received the first such type B from Farnborough and on the 18th flew it from southern England to photograph Wilhelmshaven. Unfortunately the mission failed due to bad weather. February 10 brought the first successful mission in a type B; a sortie from Debden to Wilhelmshaven and back, taking three and a half hours. On 4 February two more Spitfires, N3116 and N3117, were handed over for modification, followed on 11 February by P9307-P9310.⁵

At the same time - and in accordance with the unit's fictitious name! - experiments were carried out to optimise the unit's camouflage schemes for various reconnaissance missions, as at high altitudes the light Camotint Green proved ineffective. Various shades of green, blue and grey were tested, including *Light Slate Grey* and *Medium Sea Grey*. The standard RAF fighter colours were also used - *Dark Green* & *Dark Earth* on upper surfaces plus *Sky* and later *Medium Sea Grey* undersides. *Dark Earth* was then replaced with a specially prepared shade called Camotint Blue-Grey. After some time the high flying aircraft began to be painted with this dark colour overall. The paint was later standardized as *PRU Blue*. Although from late 1941 most, if not all, high flying PRU aircraft were finished in this colour, it did not appear in the list of standard RAF paints until 1942. In early 1940 serials started to be applied in 4" characters in light grey (most probably Medium Sea Grey). National markings were applied in accordance with general regulations, the only modification being a thin yellow outline to the fuselage roundels when applied to aircraft painted overall in dark blue-grey shades.

On 17 January 1940 Cotton's unit was renamed the Photographic Development Unit (PDU), and the next day another PR Unit, 212 Squadron was formed in France. The latter was a rather unusual organization with a varying number of Flights and aircraft. Initially it had just one Spitfire on strength, but by the time France fell it had no less than eight.

Operationally, 212 Squadron reported to the PDU with Seclin as its initial base. Subsequently, its aircraft operated from Nancy and from Meaux near Paris. 212 Squadron aircraft carried no unit or individual letter markings, just single or double digit numbers applied under the RAF serial with characters of the same size and colour.

Interestingly, although they were flying Spitfires, most PDU pilots were not recruited from Spitfire fighter squadrons. The majority of those who would become legendary recce pilots (such as Flt Lt Eric Le Mesurier, F/O Alistair Lennox Taylor, F/O S.S.G. 'Bill' Wise) came from Fairey Battle light bomber squadrons. This was because of the substantial difference in tasks between fighter and PR pilots. The latter were required to precisely identify distant targets, which required an exceptional navigator, and to avoid combat with enemy aircraft. Both were similar to the duties of Battle pilots. On the other hand, in 1939/40, RAF fighter pilots usually engaged overwhelming numbers of enemy aircraft which required bravery and a willingness to take risks. Success in PR terms meant returning to base with photographs and so calmness and avoiding unnecessary risk were prerequisites for a PR pilot. Another reason for the virtual absence of ex-fighter pilots among the outstanding PR pilots is well illustrated by John Alexander Kent, who was posted to the PDU in time for the Battle of France. After the collapse of that country he used every available opportunity to return to a fighter squadron as he '*found the photographic work very frustrating and longed to get back onto fighters where one could immediately see the results of one's efforts*'.⁶ Certainly, light bombers offered no such instant gratification and one can easily imagine that many Battle pilots were overjoyed to trade their outdated machines for the nimble Spitfire!

Since the RAF authorities would not countenance a civilian commanding the PDU, Cotton was given the assistance of S/Ldr Geoffrey Tuttle, a former flying instructor and fighter pilot, who was to be his deputy and 'guardian angel'. As Cotton mainly worked in France, Tuttle, from early 1940 took charge of the Heston based part of the PDU, now called N Flight. It is worth noting here that, in spite of several changes to the official name, the unit was still referred to in RAF documents as *Heston*

4 Early Spitfire Mk Is were fitted with two-blade, fixed-pitch propellers. Such propellers, made of mahogany, weighed 83 lbs (37.5 kg). Since a metal, variable pitch propeller was planned from the outset, early aircraft with the wooden airscrew carried special ballast of two 135 lb (61 kg) lead blocks on the engine mounting. However, after the new propellers were fitted, the removal of the ballast proved insufficient, and additional weight had to be carried in the rear fuselage.

5 Some sources claim incorrectly that P9308 was diverted for modification to type D, see page 18.

6 John A. Kent, *One of the Few*, Kimber, 1971, ISBN 7183 0142 0



Spitfire K9791 had been retained by Supermarine for development work, used for trials aimed at extending the range, which involved fitting of the enlarged 'chin' oil tank. The Spitfire was fitted with a Merlin XII, essentially becoming the Spitfire II prototype. Converted for photo-reconnaissance duties, K9791 failed to return from a sortie over the Ruhr on 17 August 1940, F/Sgt J. D. T. Taylor-Gill becoming a PoW. The captured Spitfire was then displayed with other Allied equipment at the 'Der Sieg im Westen' ('Victory in the West') exhibition in Vienna towards the end of 1940.

In the top photo note how much paler the upper surface colour appears, compared with the blue in the national markings. The code 'LY' and serial were most probably applied in Medium Sea Grey. Note that the Spitfire was fitted with a metal-bladed Rotol propeller with the early, blunt spinner. This airscrew type, definitely non-standard on Supermarine-built Spitfires in general, was typical for aircraft powered by Merlin XII engines, and was seen on many early PR Spitfires.

The other three photos show the Spitfire at the exhibition of captured Allied materiel in Vienna in the autumn 1940. Note that the fuselage roundels featured a yellow outline (rendered rather dark through film/filter combination here) while those on upper and lower wing surfaces seem to have no outline.

The head-on photo shows clearly a single tone overall scheme, even though in the top photo the bottom of the rear fuselage looked distinctively dark (probably covered in oil from the broken tank). Note how gun ports are showing – it is not clear if the filling has peeled off, or if the Germans wanted to give the Spitfire a more 'fighter' appearance.

In the bottom photo the cover of the camera compartment, hanging down under the wing (somewhat flattened, probably in the forced landing) is noteworthy. (all: W Matusiak)

Flight, but informally known as *Cotton's Circus* or the *Cotton Club*.

In spite of the 'Phoney War', in the early months of 1940 Spitfires flew frequent reconnaissance missions. It is interesting that the work was started with a careful survey of the then neutral Belgium, without the permission or knowledge of the Belgian authorities. Needless to say however, Germany was the main target.

Losses could not be avoided. On 22 March about midday, Spitfire N3069 operating from Heston was lost, shot down over Kleve by Leutnant Jung of I./JG20. The pilot, F/O Claude M. Wheatley was killed when his parachute failed to open. The first ever PR Spitfire crashed at Nijmegen at Waal (lower Rhine) in the then neutral Netherlands. Losses of PR aircraft resulted in them being assigned fighter cover, although this was not always effective. On 7 April (some sources say 10 April), west of Diedenhofen, Hauptmann Wolfgang Lippert, Staffelkapitän of 3./JG53, shot down a 212 Squadron Spitfire (possibly P9392), escorted by six Hurricanes (apparently from 87 Squadron). On 21 April N3071, the other veteran among the PR Spits, was shot down by II./JG51 over Böblingen near Stuttgart. Initially the aerial victory was attributed to Feldwebel Hans John, but later Oberfeldwebel Johann Illner was credited with the kill. The Spitfire crashed at Gross, a village to the south west of Nürtingen near Stuttgart, with F/O Cecil D. Milne being taken PoW. N3071 had been operated from France within 212 Squadron.

Losses were not only caused by enemy action; on 29 March a 212 Squadron Spitfire was damaged at Laval (150 miles south-west of Paris), when F/O W. Richmond lost his bearings returning from a sortie over Belgium and ran out of fuel. Between January and April 1940 recce Spitfires flew 557 sorties, losing 12 of their number.

PR TYPE C

The PR Spitfire concept continued to be developed and, after a period of experimentation and provisional modifications, the first more-or-less permanent version was created. The Spitfire PR 'type C' (also known as the 'Long Range' or LR) carried a 30 gallons fuel tank in a tear-drop fairing under the port wing. A similar, but smaller fairing under the starboard wing housed two F.24 cameras with 8" focal length lenses. Later some aircraft were fitted with a vertical F.8 with a 20" focal length lens, mounted in the fuselage behind the cockpit. This involved a minor modification to the aircraft control system, with the tail control links placed along the sides of the fuselage to by-pass the camera lens. In addition to the rear fuselage tank

the type C carried a total of 144 gal of fuel (59 gal more than the fighter) and had a range of over 870 miles (1,400km). This was the first variant to incorporate the enlarged oil tank under the engine, which necessitated the reshaping of the nose to create the distinctive PR Spitfire 'chin'.

The first type C (probably P9308) was ready on 18 March 1940. On 22 March F/Lt Le Mesurier flew it over Sylt, but bad weather prevented him from taking pictures. Its first successful sortie was on 6 April, when F/Lt Le Mesurier photographed Emden and Wilhelmshaven. On 7 April Longbottom flew P9308 from England to photograph Kiel. The pictures he brought home showed crowded harbours and airfields packed with aircraft. Since no one had photographed Kiel before, it was not known whether this was a normal state of affairs or not. However, a few days later events proved it was not and what Longbottom had photographed were final German preparations for the invasion of Denmark and Norway.

After the Germans invaded France, 212 Squadron's Spitfire type Bs continued operations. The rapid advance of German troops forced them to move to airfields further south - Meaux and Coulommiers near Paris. On 3 June 1940, Hauptmann Werner Mölders, Gruppenkommandeur of III./JG53 claimed a lone Spitfire shot down about 3:00 p.m. near Paris (towards Meaux). This must have been a 212 Squadron aircraft as fighter Spitfires did not fly that far into the French territory. Many Luftwaffe buffs, ignorant of PR Spitfire operations in that area, still tend to disregard this as either a mis-identified Dewoitine 520, or even a Messerschmitt 109!

On 7 June 1940, F/Lt 'Tug' Wilson flew type B P9331 (code no. 8) from Meaux to photograph the railway line Maastricht-Liege. He was forced to land at Champagne aerodrome, between Reims and Chalons-sur-Marne in the province of Champagne. P9331 was left there, and a few days later became the first PR Spitfire to be captured intact by the Germans.

No. 212 Squadron's D Flight aircraft were based at various airfields near Orleans and at Le Luc and Hyeres near Toulon, and for a few days, even at Ajaccio in Corsica. On 13 June F/O Christie, returning in Spitfire type C P9385 from a sortie over Genoa to Le Luc, encountered an Italian bomber over the coast near Monte Carlo. Without much hesitation he made stern, and then beam passes. After repeated attacks the bomber ditched. For his achievement Christie was reprimanded by Cotton, as his duty was to deliver photographs, not to play at being a fighter pilot. Especially as the Italian



bomber (probably a Fiat BR.20) was armed, while the Spitfire was not!

In June 1940 after the fall of France, 212 Squadron was disbanded. The personnel and aircraft returned to the PDU at Heston. On 16 June 1940 the last Spitfire left France from La Rochelle (some sources say Poitiers).



The fall of France ended the colourful, freelance activities of OC Sydney Cotton. When, on 17 June he returned to Britain with the last of 212 Squadron, he found an Air Ministry note, which informed him that the PDU was now a regular RAF unit (in 16 Group Coastal Command) under W/Cdr Geoffrey Tuttle.

And Cotton? Well, before he was waved 'good bye', he was awarded an OBE (Order of the British Empire) in recognition of his contribution to the development of photographic reconnaissance.

THE PHOTO RECONNAISSANCE UNIT

On 1 July 1940 the PDU was renamed No. 1 Photographic Reconnaissance Unit and assigned 'LY' as unit codes. This was usually applied in light grey (probably *Medium Sea Grey*). Individual aircraft letters were rarely seen.

The PRU consisted of three operational flights:

'A' Flight was detached to Wick in Scotland, under F/Lt Douglas Wilson,

'B' Flight was detached to St Eval in Cornwall, under F/Lt L.E. Clark and

'C' Flight was based at Heston, commanded by W/Cdr Tuttle himself.

Operational Flights were rotated between the three bases. Certainly, London's Heston was a far more attractive location than the RAF Stations at St Eval and Wick, located *in the middle of nowhere*. There was a fourth Flight, based permanently at Heston, which was responsible for training and testing of new PR aircraft.

Spitfire PR type C X4385 was one of the first machines delivered to no. 3 PRU when it was formed to operate solely for Bomber Command. When X4383 was damaged during a sortie on Xmas Eve 1940, the precious captured Zeiss telephoto lens was fitted to the F.8 camera in X4385. After no. 3 PRU was absorbed into no. 1 PRU in July 1941, X4385 continued to operate with that unit, and is believed to have been subsequently converted to type F. The Spitfire was lost on 22 September 1941 during a mission to Hamburg, coded LY-B by then. An engine failure forced the pilot, F/Lt P Tomlinson to land at Deelen in occupied Holland, where these photos were taken. Apparently, the pilot made a normal wheels-down landing, but the port leg collapsed during taxiing. F/Lt Tomlinson became a PoW.

This Spitfire seems to be in a standard scheme of PRU Blue overall with "A"-type roundel featuring a thin yellow outline. The "B" is noteworthy, aircraft letters were rather seldom seen on PRU aircraft at the time. (Top photo: Rob de Visser via Andreas Wachtel, lower photo: Helmut Terbeck)

At this time the PRU had 8 Spitfire type Bs, 3 type Cs and one type E. After the fall of France the distance from PRU airfields to the targets in Germany rose considerably, so the Spitfire type Bs were quickly modified to type C standard, which offered greater range. Between July and October 1940, 1 PRU Spitfires flew 650 sorties, losing 9 aircraft. By the end of December this rose to 841 sorties and 10 losses. Because of constant damage inflicted by German raids on London, at the end of December 1940 1 PRU moved to Benson near Oxford.

While still at Heston, a strange accident happened on 21 November 1940: P/O Ryszard Dyrzalla (a Pole), took off in Spitfire type C, P9426, with a fitter holding on to the aircraft's tail! After making a circuit and realizing the situation Dyrzalla did the best he could to land without hurting Aircraftsman 1st Class H. Rhodes. Eventually the aircraft crash-landed and both pilot and 'passenger' were hospitalised. Another Polish pilot with 1 PRU, F/O Zbigniew Wysiekierski, had been a pilot with LOT Polish Airlines, flying Lockheed L-14H airliners before the war. He joined the PRU to fly Hudsons (military variant of the L-14), and later switched to Spitfires. He was soon given the nickname 'Whisky' – much more familiar to British ears.

November 16 1940 brought the formation of 3 PRU⁷ at Oakington with a planned strength of six Spitfires and two Wellingtons. This unit worked for Bomber Command and its main duty was Damage Assessment missions after RAF bomber raids. On 23 November a Spitfire type C, X4385, was delivered to the unit and another, X4386, on 24 November. X4385 was flown by S/Ldr Patrick Bruce Bine Ogilvie, OC of 3 PRU, on 29 November on the unit's first sortie to Cologne. On 17 December X4383, the third Spitfire type C, was delivered to 3 PRU. This aeroplane featured an F.8 camera with a 750mm focal length Zeiss Likon telephoto lens taken from a German reconnaissance aircraft shot down over Britain in August 1940! First loss occurred on 12 January, when F/Lt H.C. Marshall, the commander of the Spitfire-equipped A Flight, failed to return from a mission photographing Bremen in X4386, becoming a PoW.

PR TYPE F

In the quest for increased range the PR type F (or 'Extra Long Range', XLR) was a logical step forward from the type C. It featured two 30gal fuel tanks, one under each wing. These were similar to the one under the type C's port wing. Together with three fuselage tanks this gave a total of 174gal. It also had the 'chin' with enlarged oil tank as standard. This version was the first to carry all the cameras in the fuselage, behind the cockpit. At first these were two F.8 cameras with 20" focal length lenses, later F.24 cameras with 20" lenses were fitted. Some aircraft also carried a single F.24 camera with 14" lens mounted obliquely, facing port. The type F had a range of over 1,250 miles (2,000km), enabling it to reach Berlin from East Anglia airfields.

This variant was first used in late July 1940. On 14 March 1941 Pat Ogilvie, the OC of 3 PRU, flew X4712 (the first Spitfire type F in 3 PRU) on the war's first reconnaissance sortie over Berlin⁸. Less than a month later, on 8 April 1941, this Spitfire forced-landed on the Dutch island of Texel. At least one other Spitfire type F was captured in flyable condition and subsequently used by the Germans.

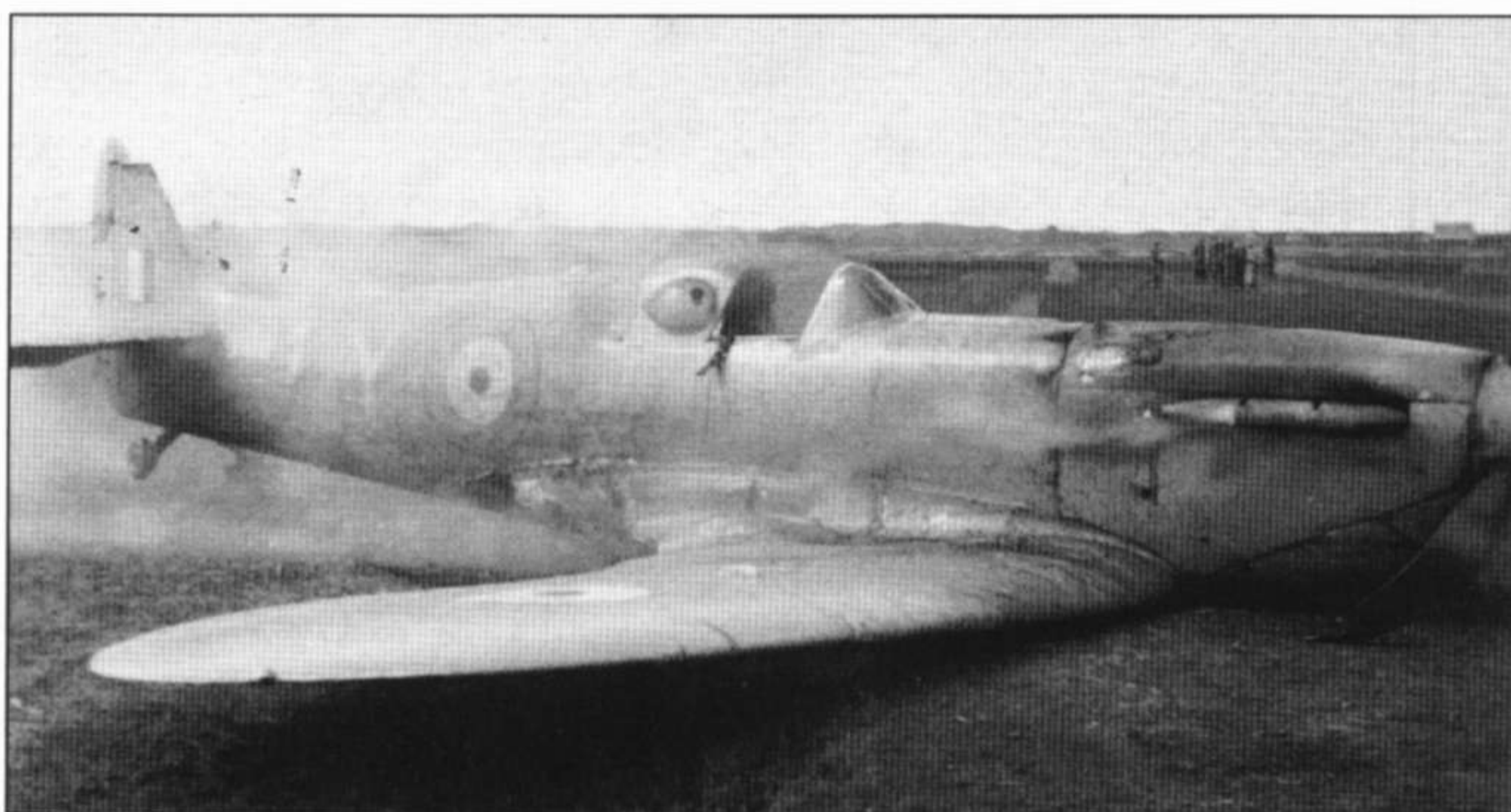
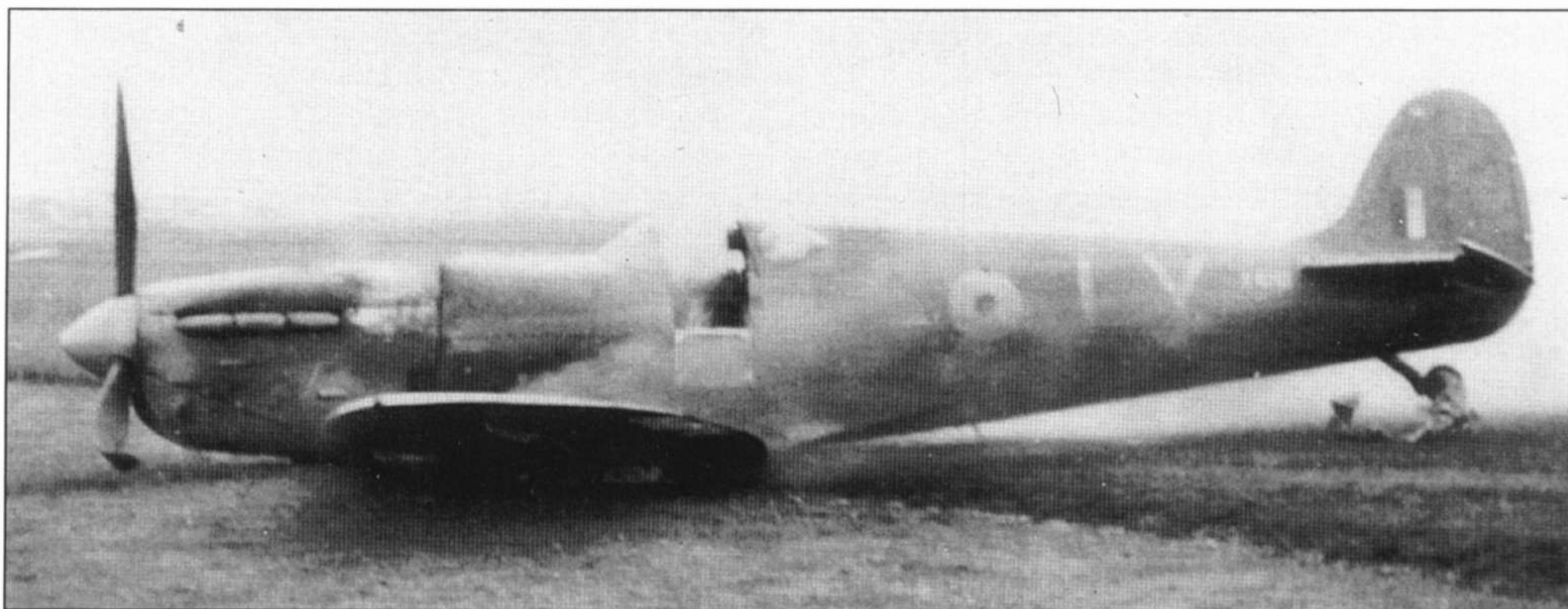
It was in a Spitfire type F that P/O Michael 'Babe' Suckling photographed the battleship *Bismarck* off the Norwegian coast on 21 May 1941. In due course this would enable the Royal Navy to find and sink the *Bismarck*.

At about that time 'B' type roundels replaced the previous 'A' type on PR Spitfire fuselages.

In June 1941 a decision was taken to unite all the PR units in Britain into a single PRU, controlled from Benson. The unit, which formally came into existence during July 1941, had 32 Spitfires plus 8 Blenheims. Existing type Cs were gradually modified to type F. Simultaneously, type C and F aircraft had their Merlin III engines replaced with the Merlin 45 (as used in the Mk V fighter variant). Externally, this modification was identified by the larger oil cooler with a circular intake under the port wing (the Merlin III used a smaller cooler with a semi-circular inlet). To distinguish them from the original Mk I conversions, these aircraft were identified in 1 PRU documents as "Mk V" with the appropriate type letter designator.

7 Meanwhile, 2 PRU had been formed at Helipolis, Egypt, but this initially had 3 Hurricanes and an impressed ex-Yugoslav Lockheed 10A, so is of no interest to us for the time being. Later, however, 2 PRU Hurricanes had a significant influence on development of a whole branch of PR aviation. The methods worked out there laid foundations for the fighter-reconnaissance aircraft, i. e. standard fighters (later Spitfires, too), fitted with additional photographic equipment and responsible for tactical recce.

8 Ogilvie's versatility was such that he also flew the first night recce sortie to Berlin - in a PR Wellington; and he subsequently became the OC of RAF's first Stirling Squadron! His name would then appear again in the PR Spitfire story.



LOW-LEVEL PR CONVERSIONS

During the Battle of France 212 Sqn was forced to switch from strategic reconnaissance duties, as originally planned, to tactical sorties supporting the army. This often required operating at low altitudes, especially when cloud (or smoke!) obscured small targets, such as bridges. In the words of John Kent, *"We were going to have to resort to low-level. This was not so amusing as we depended entirely on our speed and altitude for defence. With the prospect of this low-level role we re-equipped one of the Spitfires with its eight guns"*.

PR TYPE E

After the fall of France, battlefield reconnaissance lost its importance for a while. However, during the summer of 1940, with the imminent threat of German invasion, a constant watch was kept on continental ports which were frequently obscured by cloud, curtailing high-altitude photography. Also, as remote as these might have been, plans for the liberation of Europe were being made *even then*, so tactical reconnaissance was not completely forgotten. Work started on a specialised PR Spitfire for low altitude oblique photography and this emerged as the Spitfire PR type E. It seems that only N3117 was converted to this standard which included an F.24 camera in each wing. These faced forward, were splayed outwards slightly and aimed 15° below horizon. They were housed in fairings that extended below the wing. It probably also carried the additional 29gal fuel tank in the rear fuselage.

Spitfire X4712 was the first type F in No. 3 PRU. On 14 March 1941 S/Ldr P. B. B. Ogilvie, OC of the unit, flew this aeroplane on the war's first reconnaissance sortie over Berlin. On 8 April X4712 was shot down by Fw Nickel of the I./JG1, flying a Bf 109. The Spitfire forced landed on the island of Texel. The pilot, F/O J. H. L. Blount was taken prisoner, and the Spitfire was burnt. Contradicting accounts state that it was either the pilot or the Germans who set the Spitfire aflame.

These photos show the opening stages of the fire, which, it seems, may well have started by itself, from the overheated engine. The colour scheme looks pale overall, but the apparently dark (yellow in reality) outline to the roundel in the lower photo suggests that the photos were taken using film/filter combination that enhanced warm hues and rendered blue rather pale. It seems likely, therefore, that the aeroplane was PRU Blue overall.

(Top photo: Andreas Wachtel collection, bottom photo: W. Matusiak)

On 3 July 1940 W/Cdr Tuttle flew N3117 for its first mission, unfortunately aborted due to low cloud. On 7 July F/O Alistair Taylor photographed the Boulogne bay from an altitude of 300ft, with cloud base at 700 ft. The experience gained with the first type E proved that low flying aircraft would need armament to defend themselves if bounced by enemy fighters. Some sources also suggest that RAF HQ required the aircraft to be armed in order to support ground troops should the need arise. Experience with N3117 resulted in the PR type G, which featured machine guns and an armoured windscreen. These low flying PR versions were often identified in PRU documents under the collective designation of MR, for 'Medium Range', to distinguish them from the long- and extra long-range high-flying versions.

PR TYPE G

The PR type G was, in effect, the RAF's first fighter-reconnaissance design and featured an 'A' wing with eight machine guns plus an armoured windscreen. Compared to the fighter versions, the fuel tankage was increased only by adding the 29 gal rear fuselage tank, so that this version took 114 gal in all. The first PR type Gs were modified from Mk Is and their engines were replaced with Merlin 45s. Later machines were converted from production Mk Vs.

The camera installation consisted of: one oblique F.24 with 8" or 14" focal length lens, fitted between frames 13 and 14 (the lens axis was 13° below the horizon), plus two F.24 cameras fitted vertically. The forward one, with a 5" or 8" focal length lens, was placed under the oblique camera and the rear one – with an 8" or 14" focal length lens, was between the frames 14 and 15. In some aircraft the oblique camera was inclined slightly rearwards to reduce picture blur due to the lower relative velocity of objects photographed, to the aircraft. The general rule was to take pictures from just below the clouds. At altitudes lower than 2,000 ft (600m) the oblique camera was used; between 2,000 and 10,000ft (600m - 3,000m), the vertical camera with shorter focal length; above 10,000 ft (3,000m), the vertical camera with longer focal length was used. This was the first version with vertical cameras working separately.

SPECIALISED CAMOUFLAGE

At least until July 1941 specialised low flying versions were painted in a uniform scheme of either Green Camotint, white, or pink. The latter colour

(in fact off-white with a pinkish tinge) proved to merge better against low clouds. The effectiveness of the scheme was confirmed by Alistair Taylor's sortie in R7059 over Cherbourg on 4 May 1941. When coming out of the clouds at 3,300ft (1,000m) he encountered a pair of Bf 109s which passed some 50 yards away from him. Fortunately the Germans failed to notice him! Pink aircraft carried their serials and codes in *Medium Sea Grey*; possibly *Identification Red*, *Dull* in some cases.

From mid-1941 some type G aircraft were painted in a camouflage scheme similar to that of fighters – two-tone upper surfaces, undersurfaces in a lighter colour. The markings were sized and positioned typically for the PRU – small 'B' type roundels, reduced size fin flash and serial number in 4in. characters (*Medium Sea Grey*, *Night* or *Identification Red*, *Dull*).

Special fighter recognition markings, such as yellow wing leading edge (introduced on fighters during July 1942), or *Sky* spinner and rear fuselage band (introduced in late 1941), were not carried on these PR Spitfires (their spinners were usually black). Initially the usual RAF day fighter colours were used: *Dark Green/Dark Earth* and later *Dark Green/Ocean Grey* on upper surfaces, *Sky* or *Medium Sea Grey* on undersurfaces, although not necessarily in standard combinations. Also the *Dark Green/Dark Earth/Medium Sea Grey* set was used.

Later on, many different shades of dark grey and dark green were tested on upper surfaces, including *Extra Dark Sea Grey* and *Extra Dark Sea Green*, while undersurfaces saw use of *PRU Mauve*, *Dark Sea Grey*, *PRU Blue*, *Dark Mediterranean Blue* or *Deep Sky*. The low flying versions were never painted *PRU Blue* overall – this was standard on high flying variants only. Pioneering work on low visibility national markings was also carried out. Amended Air Ministry Orders⁹ said that ... '*Photographic Reconnaissance Unit camouflage does not necessarily conform to standard, nor are the national markings invariably carried in the orthodox positions or painted in standard colours.*' (This provision is particularly noteworthy, considering that outside the PRU any flights without proper markings were only allowed with a special authorisation from the Air Ministry plus an individual permission for each such flight from the respective military authorities.) The low-viz roundels were initially applied in Light Blue-Grey Camotint and Extra Dark Blue-Grey Camotint. Later *Light Slate Grey* and *Dark Slate Grey* were tested.

Low altitude reconnaissance missions were much more dangerous than those at high altitudes.

9 AMO A.664 of July 2, 1942 (paragraph 4.ii.c and Appendix 1 B.6). Repeated in the A.864 of September 7, 1944 (paragraph 4.).



After the camera was switched on, the aircraft had to continue straight and level during the photo-run, making it a perfect target for ground fire. The only chance to take pictures and survive was to take the defence completely by surprise. Should the first attempt fail for *any* reason the pilot was supposed to give up his task and return home. He was certainly not allowed to fly over the same defended target again that day, or the next. However, all this did not prevent losses from being so high that the missions were referred to as 'dicing with death'. Later the term 'dicing' for this type of mission was even used in official documents.

The most famous Spitfire type G missions involved finding early German radar stations. On 22 February 1941, P/O W.K. Manifould photographed the first Freya radar at Auderville. This was a second attempt - on 16 February Sgt Parrott failed to bring back pictures because of heavy AA fire. Manifould took revenge on the Germans when he strafed (against the PRU rules!) AA posts and the radar station itself, rendering it useless.

The type G was also used outside the Photo Reconnaissance Unit, in 1416 Army Co-Operation Flight, formed at Hendon in the Spring of 1941 (codes 'DP' - see back cover illustration). During the summer of 1941 the Flight was expanded into 140 Squadron (codes 'ZW') equipped with Spitfires (including some PR type Cs) and Blenheims. Some of the unit's type Gs wore standard fighter camouflage (*Dark Green/Dark Earth/Sky*, then replaced by *Dark Green/Ocean Grey/Medium Sea Grey*) complete with its usual roundels and recognition markings (*Sky* spinner and fuselage band, yellow wing leading edge). Codes and serials were standard size and position as well.

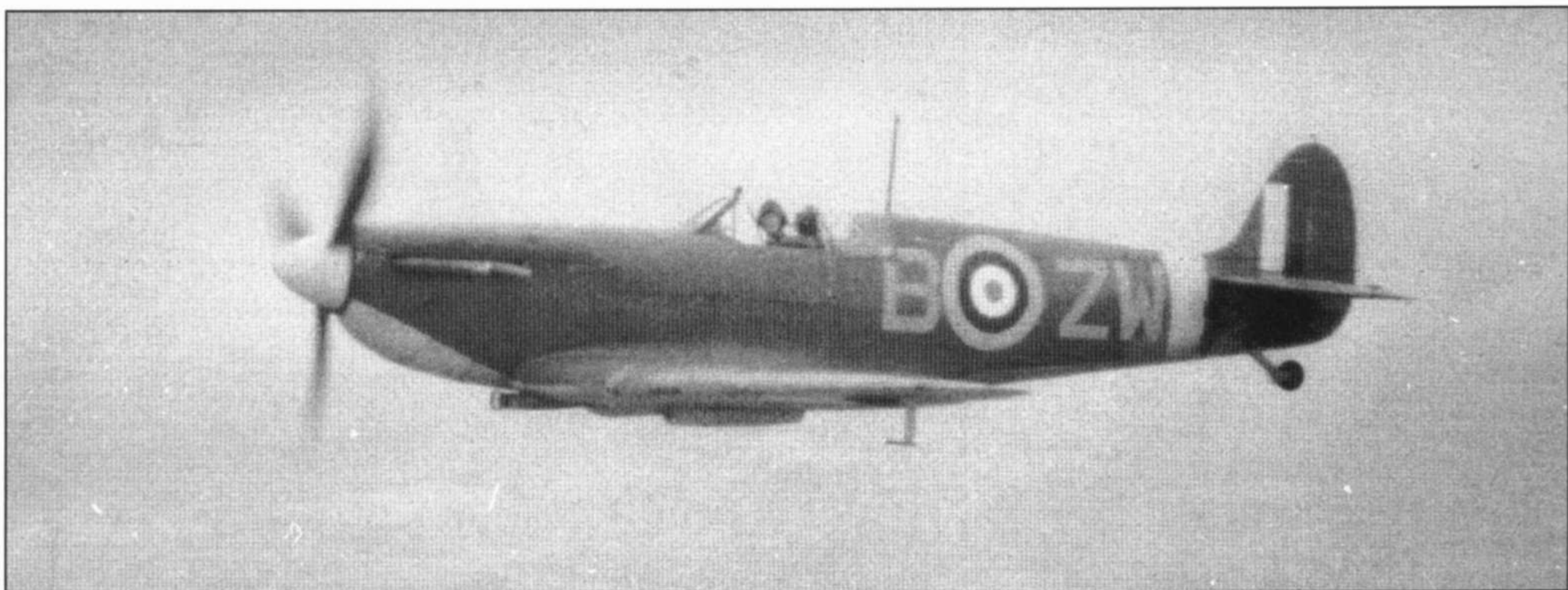
A blurry but extremely interesting photograph.

Spitfire PR type G, believed to be P9328, of 1416 Army Co-Operation Flight (codes 'DP'), which used the type during July-September 1941, until re-formed into 140 Sqn. The overall dark appearance of the aeroplane, with a just distinguishable disruptive pattern on upper surfaces, conforms with the prescribed scheme of Extra Dark Sea Grey and Extra Dark Sea Green with PRU Mauve lower surfaces.

(via C.Thomas)

Spitfire Mk I 'ZW-B' of 140 Army Co-Operation Squadron, pre-August 1941. This machine is in the Temperate Land scheme (Dark Earth/Dark Green) with Sky undersides and light grey codes. Note the typical fighter-style quick recognition markings (Sky spinner and tail band), usual for aircraft of the Squadron. There is no camera port visible, so this might be one of squadron's Mk Is used for conversion training. In fact this is a very early Spitfire with the tall and slim aerial mast and no voltage regulator on the back of the armour plate behind the pilot - both these features were typical for the Mk Is in K-L serial ranges only, which makes L1000 the most likely candidate.

(Chris Thomas)





Spitfire PR type G, X4786 in a non-standard camouflage pattern and no unit markings, May 1943. The camouflage colours are a mystery. The serial is applied in a light colour, probably Medium Sea Grey, so the lighter camouflage shade is unlikely to be Ocean Grey. Note that the fuselage roundel and the fin flash seem to have been applied in different shades. The fuselage roundel shades are similar to those of the camouflage, which may indicate that this aircraft was used for tests of low-viz roundels applied with two tones of grey. Notable also is the unusual rear-view mirror.



SPITFIRE PR MK II
MERLIN 35
MAY 1943

Many Spitfires, and not only recce versions, were used by 1 PRU's training flight. During May 1942, when the whole PR organization was rearranged, the Flight was reformed into No.8 OTU to train flying personnel for all PR units. No.8 OTU, initially at Fraseburgh, and then at Dyce, continued to use early PR Spitfires, including types C, F, and G.

PR.XIII

During 1942 work was carried at Supermarine on the type G's successor, the type H. The designation system was changed in the meantime and the new variant was called the PR.XIII (manufacturer's type 367). Twenty-six of these were constructed at Heston, all converted from existing F.Vs and PR.VIIs (see Appendix 2). The first Spitfire PR.XIII, X4615, was first flown in September 1942.

L1004, well known from many photographs, was probably the second prototype. Its prototype 'P' and yellow undersurfaces may well have come from an earlier testing programme, as this was a very changeable aeroplane.

The PR.XIII was powered by a Merlin 32 engine, specially developed for low altitude flying, with a negative-g resistant carburettor. Unlike the Seafire versions powered with the same engine, the PR.XIII could not use its capabilities to full advantage, having the standard, three-blade de Havilland 5/39 propeller, while the Seafires used four-bladed propellers. Some PR.XIII aircraft retained a full 'A' wing armament, while those modified from F.VBs had their cannon removed, leaving only the four machine guns. Instead of a bulky reflector gunsight, which seriously obscured forward view, a simplified sight consisted of a bead attached to the fireproof bulkhead behind the engine, and a reflector sight graticule applied onto the windscreen internal surface. A VHF-type T.R.1133 wireless set was fitted as standard and the photographic equipment was essentially that of the type G. However, because of the PR.XIII's greater speed at low altitude (below 6,000ft) blurred pictures were more frequent. This led to the development of a special camera, called the F.63, which featured so called IMC (Image Movement Compensation), i.e. the film was moving during photo exposure.

AD354 was the first PR.XIII into service, reaching Benson on 21 April 1943. By the end of the month 541 and 542 Squadrons – recently formed within the reorganized PRU – had a total of 5 Spitfire PR.XIIIs which in fact, did not see much use. Probably the only interesting mission was that

flown on 20 October 1943 by F/Lt Aston in AR319, to photograph the damaged German ship *Strassburg* near IJmuiden. The PR.XIIIs were mainly used for training by 541 and 542 Squadrons until the summer of 1944, and then by No.543 until its disbandment in October 1943. Apart from that, PR.XIIIs were used for the low altitude photographing of the French coastline prior to D-Day. From December 1943 on, Nos.4 and 400 (Canadian) Squadrons used them for pilot conversion from Mustangs to Spitfire PR.XIs.

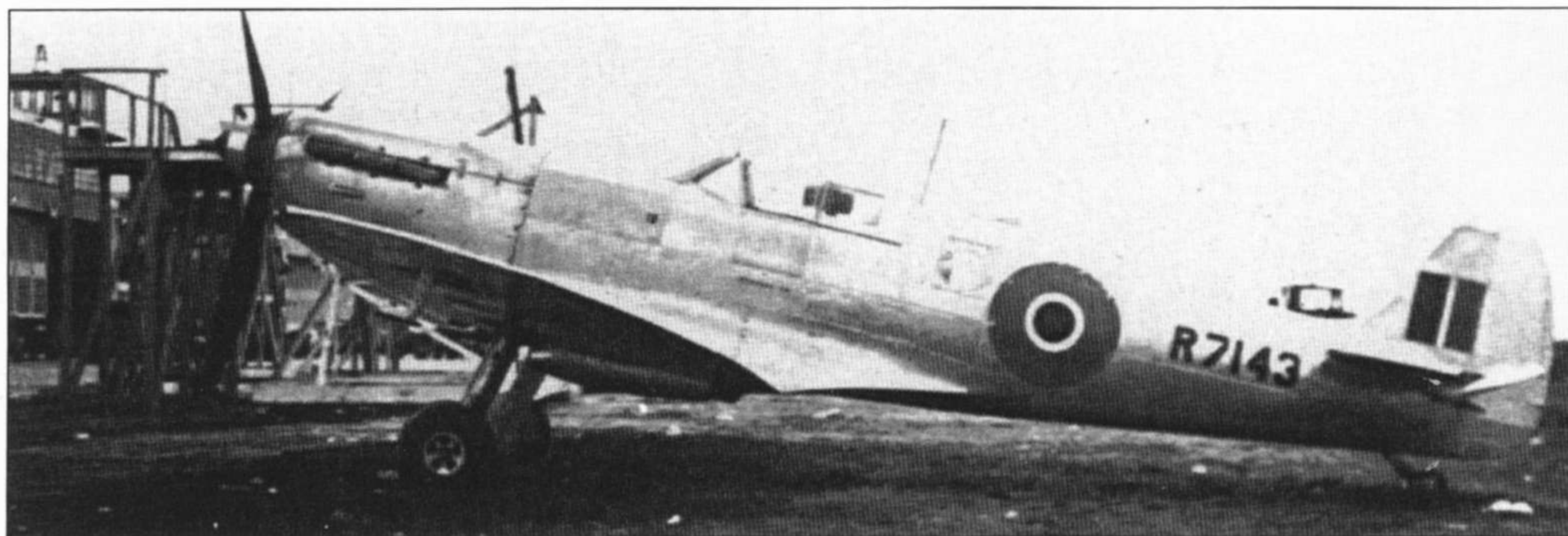
In 1944 eleven PR.XIIIs (P8784, R7335, X4021, X4615, X4660, W3831, AA739, AD501, BL526, BM591 and EN902) were handed over to the Fleet Air Arm. In February and March these were used at Lee-on-Solent and Henstridge by 808 (e.g. BM591) and 886 (e.g. P8784) Squadrons for training in PR and gunfire spotting duties¹⁰. At least some of the aircraft (e. g. W3831) went to 761 Squadron, known also as No.2 Naval Air Fighter School at Henstridge, where they were used between March and June 1944. Six aircraft (including R7335, 'G3-K') were used from June 1944 at Henstridge by 718 Squadron, which subsequently underwent several re-namings: initially known as the Army Co-Operation Training Unit, then from October 1944 as the Army Co-operation Naval Operational Training Unit, then from April 1945 as the School of Naval Air Reconnaissance and finally from August 1945, after relocating to Ballyhalbert, as No.4 Naval Air Fighter School. It was there that, in October 1945, the FAA career of the Spitfire PR.XIII came to an end.

Spitfire PR.XIIIs were usually camouflaged in a scheme similar to that of the type Gs. The regulation scheme for low flying PR aircraft was given as follows¹¹: upper surfaces were to be *Extra Dark Sea Grey* & *Extra Dark Sea Green*, with *PRU Mauve* lower surfaces and spinner in one of the upper camouflage colours. This was followed by a note that PR units were given absolute freedom as to how to paint their aircraft.

The PR.XIII was finally declared obsolete by the RAF in early 1945. However, this variant had significant influence on the development of the Royal Navy's Seafire LR.III, which remained in use until the end of the war. The RAF discarded specialised low altitude PR Spitfire variants about the time of the Normandy landings, replacing them with fighters modified to carry photographic equipment, and known as FR (Fighter-Reconnaissance) Spitfires.

10 Subsequently these units, equipped with Seafire LR.IIIs (direct descendants of the PR.XIII concept) were transferred under the RAF operational command, to form part of the Air Spotting Pool of the No. 34 PR Wing 2nd TAF.

11 Par. 52 of the Air Publication 2565A of October 1944.



PR SPITFIRES FOR CANADA

In early 1943 three PR Spitfires were shipped to Canada. On 16 January 1943 the *SS Manchester Progress* took two aircraft: X4492 (type F) and R7143 (type G) and on 10 March 1943, X4555 another type G, followed on board the *SS Tom Couston*. Both type G aircraft were stripped of their armament prior to shipment to Canada. It is known that later they were fitted with cameras having 36" telephoto lenses. They were all allocated to No.3 Training Command and 'loaned' to the Canadian No.13 Photographic Flight at Rockcliffe, Ontario, who used the Spitfires for various high altitude tests on behalf of the RAF.

Their subsequent career is described in the words of W. R. 'Bill' McRae, a veteran of RAF and RCAF Spitfire operations in Europe, posted back to Canada for rest in late 1944.

"Not long after beginning my leave I received a telegram ordering me to report to S/L Wiseman, CO of No.13 (P) Squadron at Rockcliffe. Not only did this mean I would be flying Spitfires into the fifth calendar year, but also that I would be beginning an entirely different flying role from that experienced to date.

"I had never heard of No.13 (P) Squadron, and was probably not alone. This unit was first formed at Rockcliffe as No.13 Photographic Flight on 14 January 1943. On 15 May 1944 it became unofficially recognized as No.13 (P) Squadron, but was not officially designated as such until 15 November 1946. Less than five months later, on 1 April 1947, it was re-numbered as No.413 Squadron.

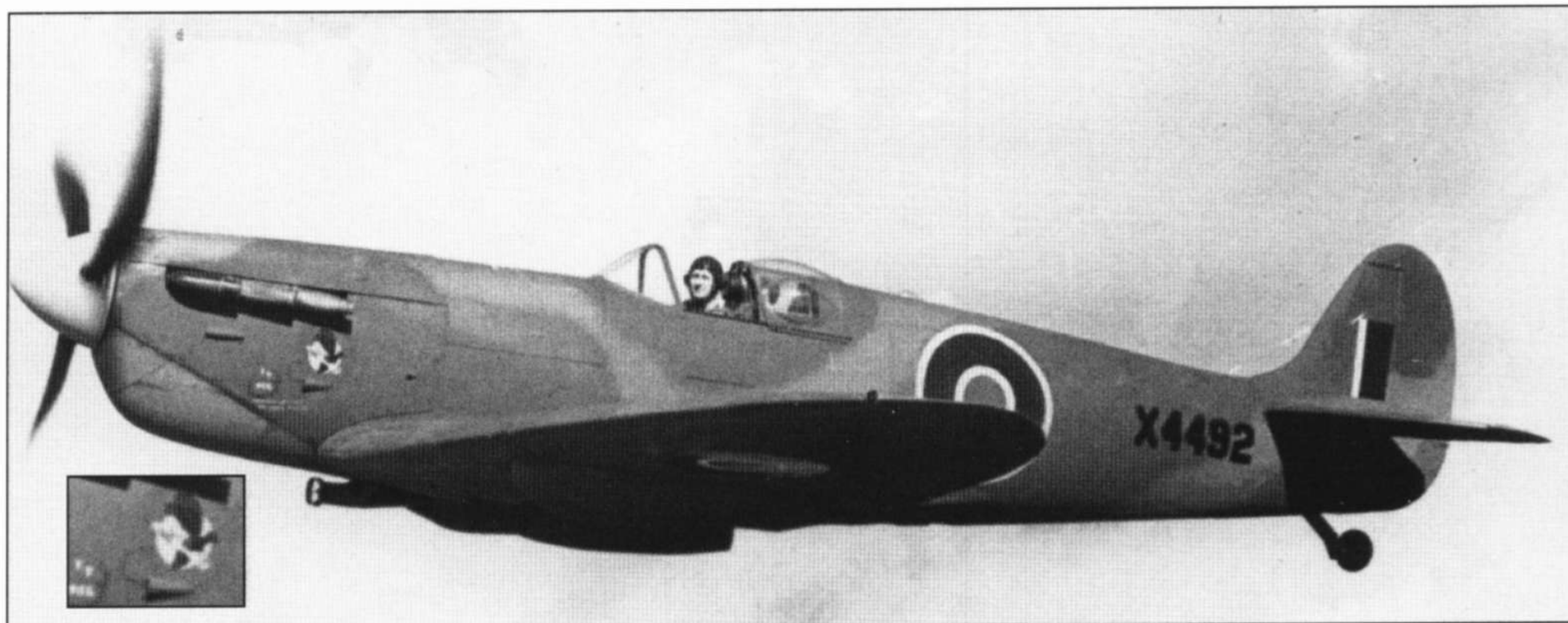
"On reporting to S/L J. A. 'Squirt' Wiseman he informed me that the unit had a Canadian built Hurricane and three PR Spitfires on loan from the RAF, serial numbers X4492, X4555 and R7193¹².

"The Spitfires and Hurricane were being used to conduct a series of camera and film tests referred to as RAF Exposures. Through the winter of 1944-45 I did about 50 of these flights and, since several others in the unit were also engaged in this work there must have been a good many done. The procedure involved climbing to the vicinity of 30,000 feet and then doing photo runs over an optical target laid out on the ground in front of the old photo building at the southeast end of the field, or some other designated target."

Officially on 15 January 1945 the Spitfires were transferred to No.1 Air Command, but 'Bill' McRae's log book shows no change in entries after that date, the Spitfire flights still being recorded under

One of the two PR type G Spitfires in Canada, R7143 has a natural metal finish with fighter style roundels on fuselage and wing undersurface. Some sources claimed this Spitfire to have been finished in PR Pink overall. If this was actually the case then certainly that finish was removed before this photo was taken. The fin flash on all three Canadian Spitfires is somewhat smaller than on fighters, but larger than usually seen on PR aircraft of the type. The note of 'SPITFIRE VII' stencilled with characters some 1 in. (2.5 cm) high is just visible under the cockpit door. Note the bulged fairing of the oblique camera port which proves that the camera in this aircraft was inclined backwards. It is interesting that R7143 features a radio mast, an item not normally mounted on Spitfire type Gs. The mast is not of any standard type, which indicates that this Canadian Spitfire (possibly all three of them) was fitted with R/T equipment once in that country. (via W.Matusiak)

¹² In fact it was R7143 as described above. R7193 was used by FAA from 1942 until 1944. 'Bill' McRae's account provided by F. Grabowski

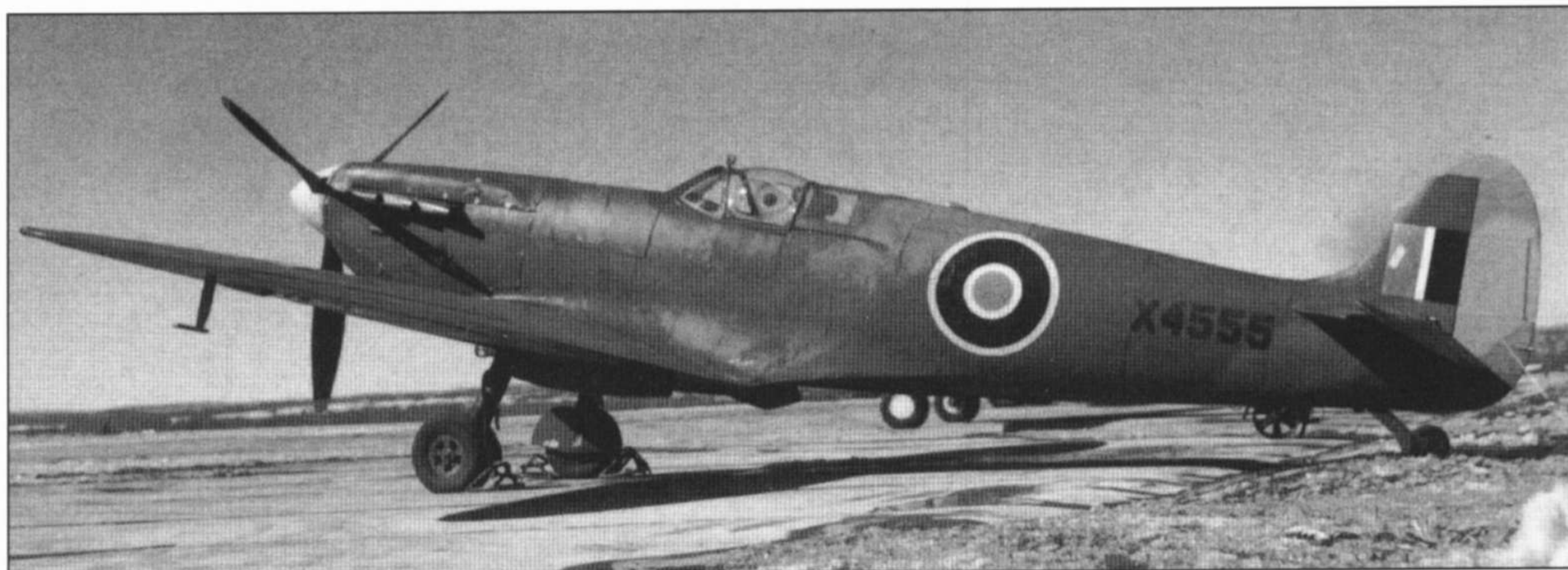


the heading of No.13 Sqn. On 9 July 1945 X4492 accomplished a very special mission: F/Lt T. Percival took photographs of the eclipse of the sun. For this mission a special F.24 camera was fitted with the lens pointing obliquely skyward.

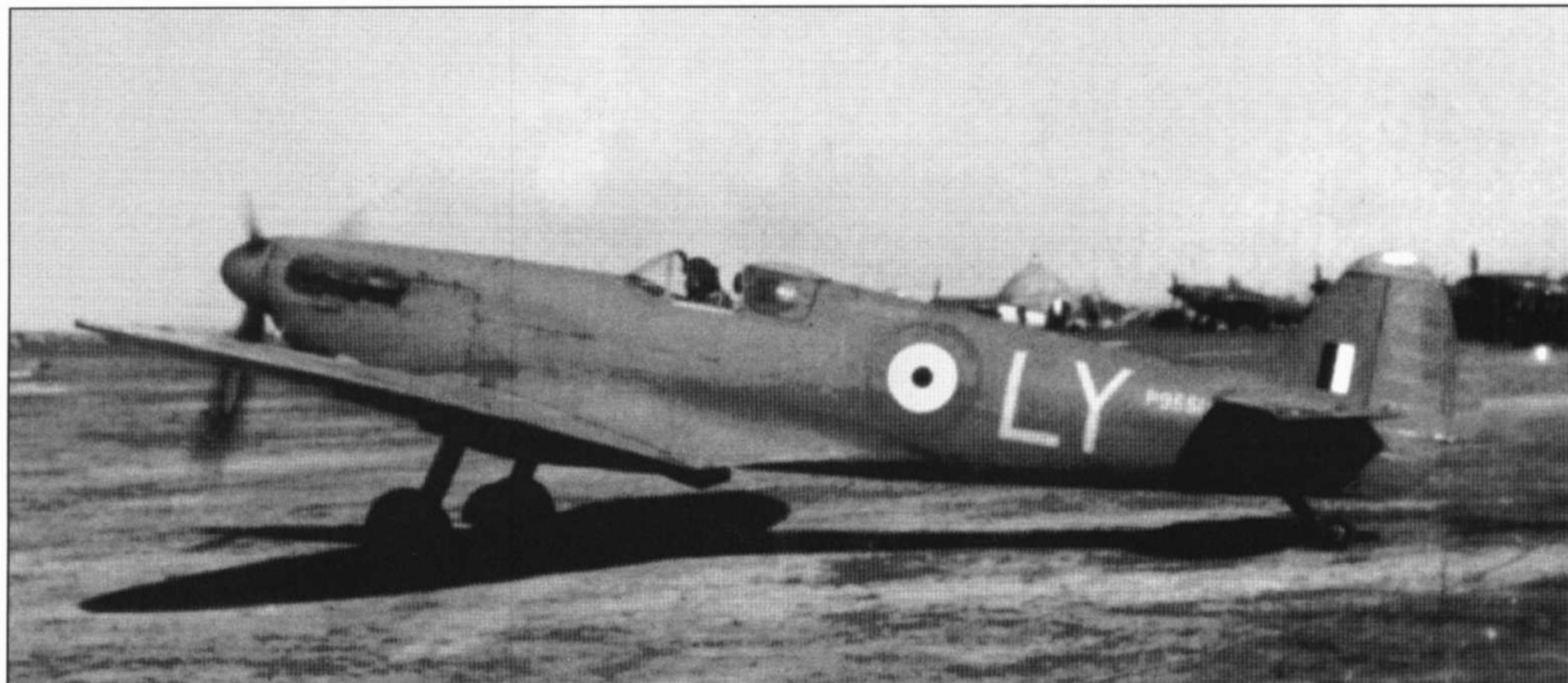
On 15 July the Spitfires were transferred to No.9 Training Group, and then on 9 January 1947 they were apparently re-assigned to Search and Rescue duties. Less than a month later, on 4 February, X4555 was handed over to the Royal Canadian Navy for ground instructional purposes. The other two followed in September 1947. Their eventual fates are unknown.

Above and left: Spitfire type F X4492 of No. 13 (Photographic Survey) Squadron RCAF. Shipped to Canada on 16 January 1943 aboard S/S 'Manchester Progress', the Spitfire was taken on charge by the RCAF on 17 February. X4492 performed a unique mission on 9 July 1945 when F/Lt T. Percival used her to photograph the eclipse of the sun. The disruptive camouflage scheme on X4492 does not conform to any standard RAF pattern, but is similar to that on Spitfire type G X4555, also used in Canada. The actual colours are not known, but may be an unknown shade applied on top of the original PRU Blue coat. The size of the serial number on the fuselage conforms with RAF regulations, but the style of the characters (used on all three Canadian Spitfires) differs from any character style seen on RAF Spitfires.

A PR type G sent to Canada, X4555, displays a camouflage pattern similar to that of X4492 but appears rather darker. This could be due to a different film or filter type. (via W. Matusiak)



FIRST PRODUCTION PR VERSIONS



PR TYPE D

In early 1940 work commenced on the PR type D. A version that would have an unprecedented impact on the development of PR Spitfires.

What made the type D so special? All of the versions described earlier were standard fighters modified at Heston Aircraft. The long-range variants for strategic reconnaissance were converted by removing armament and other unnecessary equipment and fitting cameras plus additional fuel tanks. Each new version differed mainly in the location and size of the latter. In the quest for increased fuel capacity, having exploited all easy options, a proposal was put forward to construct a special wing with large capacity integral tanks – a ‘wet’ wing. At that time the very idea of integral tanks was a novelty.

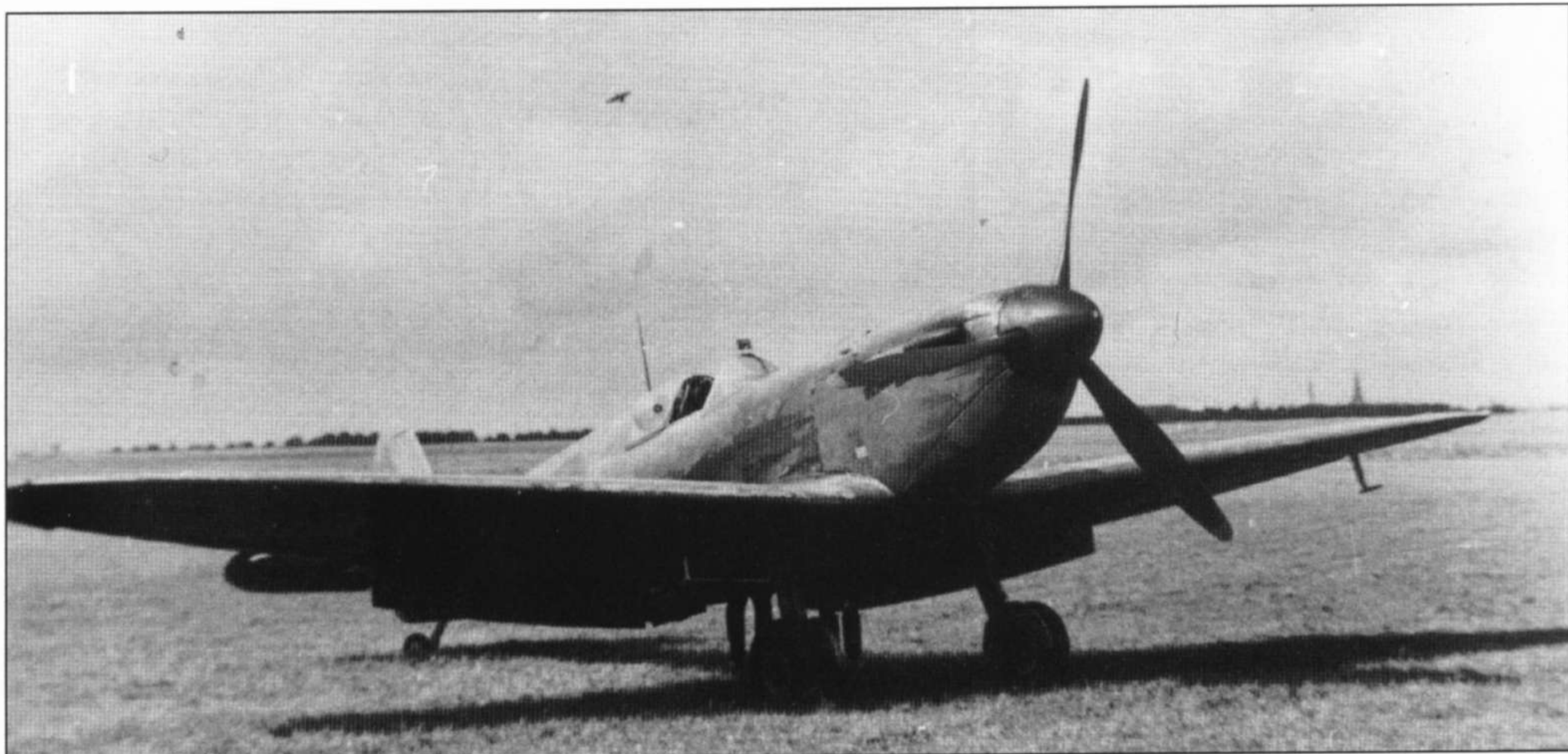
When Reginald Joseph Mitchell designed the Spitfire, the power plant for the aircraft was to have a surface cooling system using steam as a coolant. That was one reason why the Spitfire’s wing was designed in such a way that the main spar and leading edge skin formed an enclosed D-shaped section which was to constitute the cooling steam condenser. As it turned out, the Merlin was fitted with a conventional cooling system, and the space forward of the main spar was left unused. With ongoing PR Spitfire developments, new locations for fuel tanks were sought and the wing leading edge section was a natural choice. A Supermarine report for Cotton on 16 October 1939 was the first document to mention such a modification. Because of the sophisticated wing sealing process, work on the type D was carried out at Supermarine rather than Heston. However, at the same time work was in progress there on the new cannon-armed Spitfire wing. With the Battle of Britain raging, the cannon wing took precedence and the PR wing was delayed. The integral tank wing required 30% more man-hours to build than a normal fighter wing.

According to the Air Ministry order of 6 May 1940, filed as S.B.2415/C.23A, the new wing was fitted to two Spitfires, P9551 and P9552¹³. The first of these was delivered to the PRU on 21 September 1940, and the second on 26 February 1941. Each had cost £6,500. They featured a 57gal tank in each wing, and the typical PR 29gal tank in the rear fuselage, which increased the range to more than 1,700 miles (2,800km). Because of the longer endurance, an additional 14gal oil tank was fitted in the port wing’s inner gun bay.

PRU’s P9551 was the first ‘extra-super-long-range’ PR type D, and also the first ever Spitfire on Malta, from where it operated during F/Lt P. Corbishley’s short stay in late January 1941.

The overall camouflage colour is not certain. Note that it looks pretty dark, despite the fact that the photo was taken using a film/filter combination that enhanced warm hues (the red in the national markings looks very dark, and the yellow outline merges with the blue). This is another early PR Spitfire with the blunt-spinner Rotol propeller. (Mark Anthony Vella, “Malta at War” Vol. 1, Bieb Bieb publishers, 2001)

¹³ Some sources claim that as early as 1 April 1940 the first type D aircraft with integral wing fuel tanks was delivered, this supposedly being P9308. In fact, P9308 was the first type C variant (with tanks in wings, but not integral ones).



Photographic equipment consisted of two F.24 cameras with 8" or 20" focal length lenses, or two F.8 cameras with 20". Because of the extra fuel load, the type D was difficult to handle when taxiing as well as in the initial stages of flight. The aircraft was barely controllable during the first 30-60 min. of flight, until the rear fuselage tank emptied. The sequence of fuel use was as follows: first the rear fuselage tank (and the drop tank, if any), then the wing tanks (switched at 15 min. intervals to avoid excessive sideways movement of the CoG), then the lower fuselage tank and finally, the upper.

Because of the great amount of fuel that could be put into them, the early type Ds were known as 'Bowsers'. They were also called the 'Extra Super Long Range Spitfire' (to stress the advance in this respect over the Long Range type C and Extra Long Range type F). The long endurance of this version posed serious physiological problems for the pilot. The simple problem of urinating was practically unsolvable because of the freezing temperatures encountered at high altitudes.

On 29 October 1940 F/O S. J. Millen flew the first operational sortie in P9551. In 5.5 hours he took it to the Baltic ports of Germany, the aircraft reaching as far as Stettin (now Szczecin in Poland). On 19 January 1941 F/Lt P. Corbishley flew P9551 to Genoa, northern Italy. However, a navigational error took him to Corsica and from there he decided to go on to Malta, the nearest friendly territory, (this made P9551 the first Spitfire on Malta). Less than a week later, on 2 February 1941 P9551 took off, heading for Benson with the firm intention of this time photographing Genoa. Unfortunately Corbishley was not destined to reach the city. He was shot down over Viareggio and taken prisoner.

Above and below: Delivered to the RAF in late 1941, AB131 entered service with No.1401 (Met) Flight at Bircham Newton, Norfolk. On 1 August 1942 nos. 1401 and 1403 Flights amalgamated to form No. 521 Squadron. In this unit AB131 was lost on 1 September 1942 on a training 'Pampa' flight to Ireland with pilot P/O C. E. Heggveit. 'Pampa' flights were pre-raid weather reconnaissance flights over enemy territory. P/O Heggveit's flight plan was from Bircham Newton to the East coast of Ireland, as a practice mission. During this training flight AB131 was blown off course due to miscalculated direction and force of the wind. Short of fuel, and not realising that the land under him was the German occupied Europe, the pilot landed at Brustem/Sint-Truiden airfield in Belgium, where these photos were taken. Note the overpainted codes. It is believed that AB131 was later used by German experimental establishments. Many publications claim that this Spitfire was lost by 222 Sqn in April 1942, but obviously 222 was a fighter squadron and never used PR.IVs. Their April loss was Mk Vb AD131. (via P. R. Arnold)



PR MARK IV

During the few months of operation, the type D proved good enough to justify putting it into series production - the first series-production PR version.

Production aircraft received the factory designation of type 353. Soon the PR type D name was changed, according to the new standard, to PR.IV. Production aircraft had their wing fuel tanks increased to house 66.5gal and the rear fuselage tank was removed. Total fuel tankage thus reached 85gal in standard fuselage tanks in front of the cockpit and 133gal in wings, 218gal in all, which resulted in a range of 1,800 miles (2,900km). Like the prototype type D, production PR.IVs featured an additional 14 gal oil tank in the port wing inboard gun bay. Thus they had a standard fighter-style forward fuselage, without the distinctive 'chin' of the type C and type F aircraft.

A T.R.1133 wireless set was installed - this was the first PR variant to be fitted with an R/T as standard. Instead of the Merlin III fitted to the early 'hand-made' type Ds, production aircraft featured Merlin 40 series power plants, similar to Mk V fighters. Also a cockpit heating system was introduced, whereas previously the pilot only had an electrically heated flying suit. More oxygen bottles were fitted in the rear fuselage and camera heating to prevent freezing at high altitudes became standard. The maximum take off weight of the PR.IV was 7,200lb (3,270kg). Additional equipment included a type K dinghy and 1.5gal of emergency drinking water.

The first PR.IVs (R7029-R7044 and R7055-6) were modified at Heston from Mk I airframes. According to some sources the first six aircraft (R7029-R7034) were first modified to type C standard. Indeed, known photographs of R7034 show the enlarged nose oil tank, like that on the late Spitfire type Cs and type Fs. Approximately 230 Spitfire PR.IVs were built with the figure 229 quoted most often. But the exact number is difficult to establish because information varies as to how many earlier PR Spitfires were modified to type D standard. Moreover, some of the late PR.IVs were themselves modified to later Marks on the assembly line.

Meanwhile, the second type D was delivered to the PRU on 26 February 1941 and its first mission was a flight over The Netherlands, on 5 April. On the 8th Sgt W. Morgan flew the first long-range sortie in the Spitfire - to Stettin/Swinemünde (now Szczecin/Swinoujście in Poland). On the 14th Morgan flew to photograph Genoa, which had proven so unlucky for P9551, the first Spitfire type D.

It took until 8 July to deliver R7035, the first of the series-built PR.IVs. On the 11th Sgt Walker flew her for a 5 hour trip to Copenhagen. By the end of August the PR.IVs had entered service in significant numbers. As production grew, PR.IVs gradually replaced previous versions, the types C (PR.III) and F (PR.VI). Soon the PR.IV became the standard long-range PR Spitfire variant. Introducing production PR.IVs did not affect typical mission types, but it did allow sorties to reach more distant targets.

Three different camera sets could be flown in the Spitfire PR.IV and this versatility was another reason it became the first PR version manufactured in quantity, rather than modified post-production from existing fighters.

In each case the cameras were located aft of the cockpit, designated with letters:

- W - Two F8 cameras with 20" lenses; high altitude photography,
- X - Two vertical 14" lens F24 cameras and one oblique 8" or 14" F24; low level photography in bad weather (below cloud base),
- Y - One vertical 36" F52 camera; high-altitude high-resolution photography.

The W and Y sets were used when no or little clouds were expected over the target: photographs were then taken from high altitude. If the target was covered with clouds, an aircraft with an X set would be despatched, flying there and back at high altitude, but near the target descending to take pictures below the cloud base. On such mission the tactics for taking photos was the same as for low level PR variants - the type G (PR.VII) and PR.XIII. The difference lay in that those types would fly all the way at low altitude which reduced their range.

On 5 December 1941 F/O Tony Hill flew R7044, one of the first PR.IVs, when he took the first photos of a Würzburg type radar station. These were used to prepare a commando attack against the station at Bruneval, near Le Havre. On 27 February 1942 the basic elements of the radar were captured there by British commandos led by Maj. J. D. Frost. It is worth noting here that Hill's flight was made purely at the personal request of a Dr Reginald Jones, who investigated German radars, and was flown without any formal orders; perhaps because Hill had tried to photograph the radar site the day before, but had failed because of a faulty camera. The practise was not to approach a risky target on consecutive days because the defenders would tend to be more alert.

A constant watch was being kept on Kriegsmarine ports. On 15 May 1942 F/L D. W. Steventon flew to Kiel and Swinemünde. On the way he took some pictures of Peenemünde, which was not considered

of interest by British Intelligence at that time. Only much later was it realised that his photographs showed many interesting things that had earlier gone unnoticed. After all, Peenemünde was where the Germans tested their new vengeance weapons that would later emerge as the V1 and V2.

Another typical PR mission was damage assessment after bombing raids. On 31 May 1942 F/O E. D. L. Lee arrived over Cologne at 5 a.m. and was the first Allied airman to see the effects of the Operation 'Millennium' – the first thousand bomber raid on a single city.

Mk IVs were also used outside the PRU. From August 1941 the Spitfires of 1401 Meteorological Flight (reorganised into 521 Squadron in August 1942) flew so called 'Pampa' missions over Germany to gather meteorological data for Bomber Command. From late 1942 on similar tasks were entrusted to one flight of Coastal Command's 251 (Meteorological) Squadron, flying PR.IVs from Bircham Newton. Spitfire PR.IVs were also used (together with PR.VIIs and PR.XIIIs) in Army Co-Operation Command's 140 Squadron.

Spitfire PR.IVs that operated in the Middle East had a tropical filter installed, similar to those fitted to the F.V(trop), and additional desert survival gear in case of emergency landing. No.103 MU at Aboukir modified some PR.IVs to a very high-altitude variant by fitting longer wing tips and an uprated engine. The local, so called Aboukir tropical filters were also fitted, these were smaller and more efficient than the standard ones. After a long period in the heat of the sun, fuel could blow the wing tanks (as was the case with BP882). This led to the introduction of de-aerating valves on top of the wingtips and these modified Spitfires, with full tanks these vents would spray fountains like a whale when taxiing! Also, the fuel warmed up when aircraft were parked in the sun and could boil when climbing to altitude. This necessitated cooling the wings on the ground with wet canvas to avoid airlocks in the fuel system¹⁴. The tropical climate also had a negative effect on the negatives (no pun intended!). To avoid the film emulsion clouding – resulting in a loss of contrast – the developing process had to be modified. The fine desert sand complicated film drying too, since normal driers were not 100% dust-tight.

PRU REORGANISED

Between October 1942 and February 1943, 1 PRU was reorganised. Spencer Ring commanded the unit at that time, having replaced Geoffrey Tuttle

in late 1941. In the summer of 1942 the PRU had eight Flights; stationed at Benson, Mount Farm, Wick, Leuchars, St Eval and Gibraltar, as well as a maintenance and training unit at Benson. Altogether 1 PRU had 73 aircraft, including 53 Spitfires. On 19 October 1942 the organisation was split into five squadrons; 540 Sqn took over the 12 PR Mosquitoes, 541, 542 and 543 were equipped entirely with Spitfires (each with more than a dozen PR.IVs and three or four PR.VIIs) with No. 544 using a mixture of types, including Spitfires. One flight of the latter squadron was based in Gibraltar.

Since Sir Arthur Harris was not given the independent Bomber Command PR unit he had requested, it was decided that each of Nos. 541-543 Squadrons would allocate damage assessment missions to one flight as its primary task.

DOWN SOUTH AND OUT EAST

By February 1942 more than 100 PR.IVs had been manufactured and, having satisfied the needs of home PR units, deliveries commenced to overseas theatres.

The Detachment at Gibraltar, reporting directly to the PRU, was the first overseas unit to be established. It carried out missions over Spain and Spanish Morocco – illegal under international law, since Spain was a neutral country – to keep an eye out for possible war preparations there. Sgt Blythe flew the first PR.IV from Benson to Gibraltar on 14 August 1941, but because of technical problems he took no pictures. On 28 August F/Lt Steventon brought back Gibraltar's first photographs and on 25 January 1942 F/O Barber was the Detachment's first casualty, being shot down returning from a sortie over Spain. In October 1942 the Gibraltar Detachment was transferred to 544 Squadron, as its B Flight. After the invasion of North Africa on 23 December 1942, both its Spitfire PR.IVs (BR668 and BS491, the latter flown by Sgt J. E. Thomson), were sent to Marrakesh via Casablanca, where they flew clandestine missions. After the African operation, BS491 stayed in Gibraltar. In May 1943 Spitfire PR.IV BS492 flew a sortie over a distance of nearly 1,400 miles (2,200 km) over northern Spain and reaching Bayonne in France. In August BS491 repeated that achievement, but crashed at Wraxall, Somerset on the way back, after having run out of fuel. The pilot, F/Lt R. P. Johnson bailed out but was killed when his parachute failed to open. On 17 October 1943 the Gibraltar Detachment was transferred from 544 to 541 Squadron.

¹⁴ A similar problem was later encountered on a much broader scale in early Mk IX fighters, leading to development of the fuel cooler fitted in the port wing root, this device then also being fitted in initial batches of Spitfire PR.XIs (see later).

PR SPITFIRES FOR MALTA...

The first Spitfire PR.IV assigned to Malta arrived on 22 September 1941. It was flown there by P/O N. H. E. Messervy for a PR mission over Italian ports, prior to a Malta convoy (Operation 'Halberd'- 9 ships from Gibraltar). Tyre damage whilst landing grounded the aircraft on Malta for nearly three weeks, until replacement parts could be flown out from Britain. The Spitfire eventually flew 11 successful sorties from the island, before returning to Benson on 3 November.

AB300 was the first PR.IV to be permanently based on Malta, flown onto the island on 7 March 1942 by P/O Harry Coldbeck. It was assigned to 69 Squadron and used for the first time on 15 March, over Sicily. BP885 was the second, flown in on 19 March by Sgt Leslie Colquhoun. In each case the Spitfire was supposed to refuel on Malta and then continue on to 2 PRU at Heliopolis in Egypt. However Air Vice Marshal Hugh Pughe Lloyd, the Air Officer Commanding on Malta, decided they should stay on the island, where they were allocated to 69 Squadron. Lloyd was notorious for keeping aircraft intended for other theatres in Malta; he simply took advantage of the strategic position of the island, which was the necessary refuelling spot for all aircraft flying over the Mediterranean to Egypt and the Far East. In Egypt, which suffered greatly from Lloyd's 'Hijacking', he was even known as 'Sticky Fingers'! A third PR.IV, BP906, failed to reach 69 Squadron because it force-landed in Africa on 1 April, and was interned with its pilot, by the Vichy French.

By June 1942 there were four Spitfire PR.IVs on Malta, the additional two being BP908 and BP915. They equipped B Flight of 69 Squadron (A Flight had Baltimores, Beaufighters and Mosquitoes and C Flight, Wellingtons). Despite the best efforts of the ground crew the squadron's aircraft were never all flyable, for example on 25 June, P/O Coldbeck had to carry out an observation sortie in a Spitfire Vc, since no PR.IV was flyable. On 10 August the same pilot carried out an unusual duty when he dropped a package of mail from Italian POWs over the airfield at Catania, Sicily, while returning from a PR sortie to Naples. As reinforcements, two PR.IVs were released from 2 PRU during August 1942. One of these, BP911, was flown in on 11 August by 69 Squadron's new OC, Adrian Warburton, a famed and somewhat controversial PR pilot.

First loss among 69 Squadron's Spitfires came on 19 September 1942, when New Zealander Sgt Frank Gillions flew AB300 on the unit's 363rd PR.IV mission, to photograph Lampedusa Island and the Sicilian coast. AB300 was generally considered

a 'rogue' among the pilots and this time too, the engine started to produce heavy smoke for unknown reasons, forcing Gillions to bail out over Agrigento to become a PoW.

On 14 October 1942 Adrian Warburton heroically saved the lives of two British airmen. In the morning one of the PR.IVs discovered the German steamship *Trapani* not far from Malta, escorted by the Italian torpedo boat *Medici*. Three 227 Squadron Beaufighters were immediately sent to attack, with Warburton accompanying them in Spitfire PR.IV BR665. Beaufighter X8091 was shot down, its pilot P/O Bryce and navigator Sgt Cole finding themselves in a dinghy in the middle of the sea. Seeing them, Warburton overflew *Medici*, under heavy fire from the Italians, to make them aware of the men to be rescued. Although bounced by six Macchi 202s, he kept evading them and coming back over the ship to point out the direction towards the dinghy. Finally the captain of the boat got the message, changed his heading, and rescued the British airmen. 'Warby' was awarded the second bar to his DFC for this act.

On 10 November 1942 P/O Coldbeck, the first PR Spitfire pilot of 69 Sqn failed to return from a sortie to Taranto in BS367. He was shot down by AA fire over the Italian navy base at Augusta, Sicily, and became a POW.

In February 1943, within the general expansion of PR operations, 69 Squadron's B Flight was reformed into 683 Squadron.

...AND NORTH AFRICA

In spite of 'Sticky Fingers' Lloyd's activities, the first Spitfire PR.IVs reached 2 PRU at Heliopolis, Egypt, during March 1942 – these were AB312, AB421, BP882, BP883, and BP904. Since its formation on 17 March 1940, 2 PRU had been commanded by another interesting character, S/L Hugh MacPhail; usually seen with his two dogs (a bullterrier and dachshund), MacPhail had flown his first reconnaissance missions in March 1940 in a Lockheed 14 over the USSR. He photographed oil fields around Baku and Batumi, in preparation for raids to destroy the principal fuel source of the then flourishing Soviet-German coalition. 2 PRU's first operational sortie in a Spitfire was flown on 29 March 1942 by F/L Pearce over Patras in Greece, in BP883. Further PR.IVs trickled in, and by August 1942, 2 PRU had 18 Spitfires. Meanwhile, during June 1942, command of 2 PRU was taken over by S/L Roger Whelan, a Canadian.

In July 1942 285 Wing was formed at Air Headquarters, Western Desert, in order to co-ordinate all PR work. Apart from 2 PRU the Wing



A PR.IV in the overall Royal Blue scheme, typical for the Mediterranean. According to the author of the photo, Bill Costin, this Spitfire was flown by F/Lt Warburton when photographed in 1942. Although the serial (in 2 in. black characters on the rear fuselage) is not clear, this might be BP885, the second PR.IV delivered to Malta in March 1942. (Bill Costin via Peter Arnold)

included 1437 Strategic Reconnaissance Flight RAF and 60 Sqn SAAF, flying Martin Baltimores, along with 208 Sqn RAF and 40 Sqn SAAF who flew tactical reconnaissance missions with Hurricanes. 2 PRU Spitfires flew over North Africa, Crete, southern Greece, and from time to time aircraft were detached to Cyprus or Palestine.

The Battle of El Alamein in October 1942, was the first campaign where a comprehensive photographic reconnaissance of the battlefield was undertaken on all levels; strategic (2 PRU), medium-level tactical and minor tactical help for individual army units. The concepts developed during this battle formed the basis for tactics subsequently used on all fronts of the war.

During the winter of 1942/43 the post of Command Photographic Officer, Middle East was passed to W/C Patrick Ogilvie. In the general reorganisation, No.2 PRU in Egypt was renamed 680 Squadron, on 1 February 1943.

After Libya was retaken, northern Greece (Thessaloniki area) now came within range of the PR.IVs flying from Tobra. The first mission to Thessaloniki was flown by 680 Squadron's OC, W/C Whelan, in AB310 on 30 May 1943. During 1943, 680 Squadron also flew some clandestine missions and during these at least three Spitfire PR.IVs were forced to land in Turkey.

In the summer of 1942 two Spitfire PR.IVs were sent from Takoradi - the allied aircraft ferry route to Egypt passed through here - to Freetown, where a special PRU was formed at Yundum, Gambia to operate these two Spitfires, along with a pair of Hurricanes and a Hudson. Their job was to keep watch of French forces in West Africa - Casablanca in particular. Having completed 184 missions, the unit ended its activities in December 1942, owing to the lack of French activity. The Yundum detachment's results were not considered very important and the intelligence gathered was sent to London by sea, which usually took several weeks! PR units were also based from time to time in Sierra Leone and Nigeria.

Immediately prior to Operation Torch, 4 PRU was formed under S/L A. H. W. Ball at Gibraltar, from where six Spitfires flew missions over Algiers, Oran and Casablanca. On 13 November 1942, 4 PRU moved from Gibraltar to Maison Blanche near Algiers, from where its Spitfire PR.IVs continued photographing German airfields and ports in North Africa. Maison Blanche was within range of enemy fire at that time and frequently Spitfires were damaged on the ground. In February 1943 4 PRU was renamed 682 Squadron.

THE FAR EAST

5 PRU had been active in India for some time, using a mixture of PR-modified Buffaloes, Hurricanes, B-25s, and other available types. In May 1942 it was renumbered 3 PRU, as this number had been vacant since July 1941. On May 16 W/C 'Bill' Wise, a 'Cotton Club' veteran, was posted to India to command the unit. On 10 October 1942 two Spitfire PR.IVs, BP911 and BP935, arrived for 3 PRU at Dum Dum airfield, near Calcutta. These machines had previously flown with B Flight of 69 Sqn RAF on Malta. BP911 was actually the Spitfire 'borrowed' from 2 PRU in Egypt by S/Ldr Adrian Warburton and flown to the island by him.

The first operational Spitfire sortie in the Far East was flown by W/Cdr 'Bill' Wise on 19 October 1942, to Shwebo, Mandalay, Maymyo and Monywa. This was the first ever operational sortie by a Spitfire in the Far East - fighter Spitfires would not arrive in the theatre until 1943. By the end of October the unit had four PR.IVs, all from the Middle East and fitted with tropical filters. At the close of 1942 long distance PR missions were flown mostly in twin-engine North American B-25Cs, while the Spitfires and PR Hurricanes were used over the fighting area - Arakan and the coast as far as Ramree Island. By the time 3 PRU was renamed 681 Sqn on 25 January 1943, the unit boasted four B-25Cs, seven Hurricanes and six Spitfire PR.IVs.

Early 1943 brought difficult weather conditions, which sometimes prevented flying for several days. Not unusual either were unsuccessful missions because of heavy cloud cover over the target. One of the regular targets for 681 Sqn was the 690 m long Gokteik viaduct on the Mandalay-Lashio railway line with its highest point no less than 10 m above the valley. It was first photographed on 13 March 1943, to prepare for an attack by the Chindit's 77th Indian Brigade under Maj. Gen. Ord. C. Wingate. The attack was eventually abandoned, when it was found that the line had little importance for the Japanese, but it would become extremely useful for the Allies, once they started offensive operations.

South Asia's tropical climate brought further dangers. On 8 June 1943 PR.IV AB318, flown by W/O Brown, flew into a thunderstorm at an altitude of 7,600m when returning from Lashio and Loiwing, above the Ganges estuary. The gale literally tore the Spitfire apart and Brown



Two pictures of a North African based PR.IV in the overall Royal Blue scheme, typical for that theatre. Aircraft in this finish featured B-type roundels on the fuselage and wings (including the wing under surfaces, unlike their Britain-based counterparts), but no fin flash. The roundels were applied with a lighter shade of blue, possibly Azure Blue. (C. Hugo)

Another PR.IV in the overall Royal Blue scheme, forced to land in the German-held Crete. (W. Matusiak)



only regained consciousness after free falling to about 1,500m. He luckily managed to open his parachute at this point. AB319/J was another loss. On a mission to Meiktila Sgt P. S. Marman crash-landed near Alethangwin, behind Japanese lines and although wounded, he somehow managed to get back to his unit. To prevent the precious aeroplane falling into enemy hands, a group of 45 Sqn Vengeance's was sent on 9 July to destroy it. Not every downed pilot was as lucky as Marman. F/O Gordon-White went missing on a sortie in AB316/D. It was found later that he was captured by the Japanese, tortured and burnt alive.



Spitfire PR.IV BR416 in overall Royal Blue scheme, typical in North Africa. Unusually for this finish, the Spitfire sports code letter 'X' and the serial in pale colours. Note the wingtip of another PR Spitfire in the foreground, seemingly in standard PRU Blue finish. The wingtip relief valve for the fuel tank is shown to advantage. (via P. Arnold)

CAMOUFLAGE AND MARKING VARIATIONS

It is generally accepted that Spitfire PR.IVs were painted PRU Blue overall in Europe. This rule was not followed in North Africa however, where different air transparency characteristics made PRU Blue too bright at high altitudes. As a result Spitfire PR.IVs were often painted Royal Blue overall in that theatre. Aircraft painted that way did not generally carry fin flashes, but they did feature roundels under their wings. Because of the similarity of Roundel Blue and Royal Blue shades, the national markings were applied with a lighter shade of blue, possibly Azure Blue.

Photos also exist of a Spitfire PR.IV in Africa with bottom and side surfaces painted in a very light colour (possibly white or Sky), while the upper surfaces were in a darker shade, probably Royal Blue.

Another possible exception was the reported Camotint Green camouflage on the aircraft sent to the USSR.

At the end of 1942 early Spitfire PR.IVs of 3 PRU at Dum Dum were Royal Blue overall, (as per the Middle East) and carried no fin flash. They wore B type roundels. Since on the all blue aeroplanes the outer roundel ring was hardly discernable (especially as the paints would fade fairly quickly in the tropical sun), the roundels received a yellow

Bottom of page: The same machine in an altered scheme, with sides and undersurfaces repainted white (or Sky). It seems that the fuselage roundels remained in the pale blue style. It is sometimes claimed that BR416 was used in this scheme by No. 1437 (Strategical Reconnaissance) Flight RAF. In fact documents of the flight make no mention of any Spitfire use at all. BR416 was used by 2 PRU/680 Sqn from late 1942 until 1944. During this time the Spitfire was flown, among others, by Capt. 'Jerry' Orr SAAF, who is posing in this photo. (Steven McLean via Peter Arnold)



outline. Code letters (only individual aircraft codes were carried) were 24" high in Sky. Serials were 4" high in black. Later PR.IVs, coming directly from the factory, were PRU Blue overall with standard 40in. roundels on wings and the 30" variety on the fuselage, while fin flashes were 12" wide.

On 24 June 1943, after permission was granted by London, Air HQ India introduced new, smaller, national insignia, with white in place of red. These 16in. roundels would have a 6" white centre. All other sizes: 30" 40" and other, would have a 9" white centre. The fin flash would be 24" high and the width would be (blue then white): 6-12", 9-15" or 9-27". with the blue as the rear portion. These markings would be applied to all aircraft used to the east of 60° E longitude. ie. east of the Gulf of Oman. The size would depend on the dimensions of the aeroplane with the Spitfire generally receiving the smallest size. The twenty-ninth of September introduced further changes; Spitfire roundels (both on wing and the fuselage) would have the outer diameter of 16" with 6" white centres, fin flashes would be 24" high and 16" wide (8 inches of white and blue). It was also suggested that the white should be replaced with a 4:1 mixture of white and Roundel Blue, thereby creating a pale blue shade. Individual code letters were applied locally, usually 18" high, in either Sky or the mixed light blue, as per the national insignia. Serials were repainted black, light grey, white, or mixed light blue, with characters 6 or 8 inches high.

THE RUSSIA CONVOYS

After the disastrous PQ17 convoy was decimated on its way to Murmansk in July 1942, it was decided to send an RAF detachment to the USSR. This would include a few photo-recce Spitfires under codename *Orator PRU*, to keep watch on the German battleships in Norwegian fiords. Film would be developed on site, using British equipment brought in by the unit's ground party. Based in the northern areas of the Soviet Union, the photo-recce Spitfires would provide up-to-date intelligence with the information obtained being delivered to the temporary Royal Navy base near Murmansk and also sent back to Britain.

Three Spitfires of No.1 Photo Reconnaissance Unit were scheduled to move to Vaenga, near Murmansk. It was obvious from the outset that the Spitfires would not be able to do the return trip, since the distance was nearly equal to their range. When flying eastwards, they could use favourable winds, and the vast Soviet territory gave the option of landing at another airfield should they become lost. On the way back however, the Shetland

Islands were the only possible landing place and any navigation error or adverse wind would result in disaster. In the event the three aircraft flew from Sumburgh in the Shetlands to northern Russia on 1 September 1942, landing at Afrikanda airfield near Kandalaksha, on the White Sea. The trio included F/Lt Edward A. 'Tim' Fairhurst (in command of the PR detachment), F/O Donald R. M. Furniss and F/O Gavin William 'Sleepy' Walker. Their route went over occupied Norway, neutral Sweden and Finland, (then a German ally against the Soviets). The distance of over 1,300 miles (2,100km) took four and half hours. The following day the team moved to Vaenga.

Camouflage and markings of the aircraft have raised some doubts. According to some British sources they were painted Camotint Green overall. If true this would be most interesting information, as it is widely assumed that from late 1940 on, all long-range PR Spitfires were painted PRU Blue. Soviet sources say the Spitfires were in standard PRU Blue finish, although the Russians had never seen PRU Blue before! However, it must be stressed that the photos of the Spitfire PR.IV tested at Akhtubinsk were taken in May 1943 (so they must have come from Operation *Orator*) show a rather dark camouflage, darker than Camotint Green. Still, it is not impossible that the aircraft had been repainted by the Soviets by the time these photos were taken. Also, it is not clear whether the aircraft were marked with red stars before leaving the UK, or in the USSR. It would have been logical, however, to apply the stars before the ferry flight. After all, the danger of Soviet fighters shooting down unknown aircraft without stars was definitely more likely than the threat of RAF fighters attacking Spitfires. It is worth noting that the Soviets shot down at least one RAF Handley Page Hampden on the way to Vaenga.

On 9 September one of the *Orator* Spitfires was damaged during a German air raid when a bomb fell just outside its pen, (some Soviet sources say the Spitfire suffered an accident when landing after a training flight). This Spitfire was later cannibalised to obtain spares for the remaining aircraft. The first recce mission was flown by F/Lt Fairhurst on 10 September. On 19 September Sgt Donald R. I. Hardman (a New Zealander), flew in the fourth PR.IV. By that time one of the Spitfires had suffered a damaged propeller, when F/O Walker was shot at by a Soviet fighter whose pilot was 'testing his guns'! Luckily, Walker managed to land safely and the damage proved repairable. Sadly, barely a week later on 27 September F/O Walker, flying BP889, failed to return from a low-level mission



Rear port view of the Spitfire PR.IV tested at the NIIVVS. Note that overpainted areas where RAF roundels have been are prominent on wings, but not on the fuselage. (P. Butowski collection)

to Altenfjord. It is believed that he was shot down and killed by a Fw 190A of 11./JG5 *Eismeer* (based at Alta), at approx. 11:30am local time. Witnesses said the Spitfire overflew Banak airfield, a Luftwaffe bomber base, at an altitude of some 300m, and was subsequently intercepted by fighters and shot down some 15km north of the airfield; possibly by Lt. Günther Kirschke of JG5, who is recorded as having crash-landed his Fw 190A-2 (W.Nr. 490) at Alta after a combat sortie.

PR SPITFIRES FOR THE SOVIETS

The last (successful) recce mission during Operation *Orator* was flown by RAF pilots on 15 October 1942. A few days before sailing back home, on 18 October (according to the Soviet sources on the 20th), the British handed the three surviving Spitfires (AB132, BP891 and BP923) over to the *Voyenno-Vozdushniye Sily Severnogo Flota* (VVS SF; Air Force of the Northern Fleet). Thus the VVS SF became the first operational user of PR Spitfires outside the RAF!

The Spitfires were taken on charge by 2 *Gvardeyskiy Aviatsyonniy Polk* (2 GAP; 2nd Guards Air Regiment), and subsequently re-allocated to the 28 *Otdelnaya Aviatsyonnaya Eskadrilya* (28 OAE; 28th Independent Reconnaissance Squadron). By the spring of 1943, 28 OAE gave way to the 3rd *Eskadrilya* of 118 *Otdelnyy Razvedyvatelnyy Aviatsyonniy Polk* (118 ORAP; 118th Independent Reconnaissance Aviation Regiment), commanded

by Hero of the Soviet Union, *Kapitan* (Captain) Viktor Aleksandrov. According to a report dated 1 January 1943, the VVS SF had two Spitfires on charge at that time. On 28 February 1943 one of these Northern Fleet Spitfires suffered an accident at Zubovskaya near Murmansk, owing to 'crew error'. The pilot escaped unhurt.

Some time between October 1942 and April 1943, one of the Spitfires (believed to be AB132) reached the establishment known by the lengthy name of *Nauchno-Issledovatel'skiy Institut Voenno-Vozdushnikh Sil Rabocho-Krestyanskoy Krasnoy Armii* (NII VVS RKKA; Scientific-Research Institute of the Air Force of the Workers'-Peasants' Red Army), generally referred to as the NII VVS. Soviet documents are consistent in stating that the aircraft in question was "a reconnaissance Spitfire VB". Available photographs of the machine, as well as the written description (fuel tanks in wing leading edge) identify it as a Spitfire PR.IV. Some sources claim that at least one Spitfire Mk Vb was modified to PR.IV standard (first Spitfire Mk Vs started to reach the Soviets in early 1943). It could be that the Spitfire damaged on 9 September 1942 was repaired using Mk V parts. Notably, Soviet PR Spitfire wreckage recovered in Norway included some Mk Vb parts never fitted in standard PR.IVs. The Spitfire tested at Akhtubinsk was powered with a Merlin 46 engine and had three F24 cameras with 14" lenses, each having 125-frame film magazines (the standard X set camera arrangement). According



Front starboard view of the Soviet Spitfire. The quality is very poor, and Russian typescript of the test report is showing through, but the small star on the engine cowling stands out clearly. (via K. Choloniewski)

to a Soviet test report dated 15 May 1943, usefulness of the unarmed PR.IVs was limited. Their policy at that time required recce aircraft to be armed in order to defend themselves, or attack recce targets if recognised important.

About mid-1943 the trials machine returned to the VVS SF unit that used the other Spitfires (or whatever was left of them by that time). Meanwhile, in April and May 1943, a VVS SF unit's Spitfire apparently photographed Altenfjord, following a request from the RAF.

September 1943 brought the second detachment of Spitfire PR.IVs to the USSR, under the codename *Source*. Three 543 Squadron Spitfires (believed to have been AB423, AB427, BR658) flown by S/Ldr F. A. Tony Robinson, F/O B. Roy Kenwright, and F/O John H. Dixon, flew to Vaenga from Sumburgh on 3 September 1943. On 4 September 1943, the very day the British arrived, *Starshiy Leytenant* (senior lieutenant) V. N. Solovkin went missing on a Soviet Spitfire recce mission to Altafjord.

On 22 September *Tirpitz* was damaged by a midget submarine attack. Soviet sources state that the best photographs of *Tirpitz* preceding the attack, were taken on 12 September by *Kapitan* L. I. Yelkin of 118 ORAP. The RAF detachment carried out a total of 31 recce sorties, 25 of which were successful. They must have done a good job as, in recognition of his team's efforts S/Ldr Robinson was awarded the Soviet Order of the Great Patriotic War, First Class. For this he was entitled to a lifetime pension equivalent to £1 per year. However, he would only receive this pension for five years – until the Cold War started in earnest.

On 6 October *Leytenant* Belikov suffered a flying accident at Vaenga, escaping unhurt. As the British

team, with more experience on Spitfires than their Soviet counterparts, was there, it seems likely that the damage may have been repaired with their help. On 1 November the British PR personnel sailed for home – leaving their Spitfires in the USSR – only to find 543 Squadron disbanded in their absence.

On 3 November 1943 *Starshiy Leytenant* Belyakov went missing from a recce mission over Altafjord. On 22 January 1944 L. I. Yelkin was awarded the Golden Star of the Hero of the Soviet Union (the highest Soviet wartime decoration) for his achievements in aerial reconnaissance. Barely a month later, on 29 February 1944, he was posted missing on a sortie. That day a Spitfire PR.IV of 118 ORAP crashed into a mountain in Norway, killing the pilot. Parts of this aeroplane, discovered in 1972, were salvaged in 1989 and although no serial number was found, the remains showed traces of numerous paint shades used by the Russians. Several hues, close to, but differing from, the original PRU Blue can be distinguished. This aircraft also wore a small red star on the engine cowling, similar to the Spitfire tested at NII VVS.

The last RAF PR Spitfire operation in the USSR, codenamed *Operation Tungsten*, involved S/L Don Furniss (*Orator* veteran), F/O J. H. Dixon (*Source* participant), and F/O E. G. Searle. It is believed that four Spitfire PR.IVs: BP884, BP917, BP926, and BP929, were earmarked for this operation (one remained in Britain as a spare). By that time PR.IVs were no longer used on photo-recce operations by the RAF in the western European Theatre, having been phased out in favour of later variants. On 7 March 1944 three Spitfire PR.IVs of 542 Squadron flew from the Shetlands to Vaenga. Carburettor problems made Furniss descend below 3,300ft



Port view of the Spitfire PR.IV tested at the NII VVS in late 1942/early 1943. Note the small star on the engine cowling, in addition to those on the fuselage and tail. With the Russian climate, the snow on the ground might indicate any time between November 1942 and April 1943. (via K. Choloniewski)

(1,000m). Russian ground fire damaged his aircraft, resulting in a force-landing at Afrikanda. Missions were undertaken from 12 March and excellent photos of *Tirpitz* were obtained the following day. On 2 April Furniss again experienced engine problems and when he returned to base, a pair of pliers was found in the oil cooler air intake!

The *Tirpitz* was attacked on 3 April, but it was not until the 7th that the weather permitted damage assessment photos to be taken and even these were not very useful, as the ship lay in a deep shadow. At that time the Spitfires were suffering from continuous technical troubles, so the spare machine was ferried from Britain by F/O Gorrill. He did not make it to Vaenga, however, since he had to force-land near the front line due to mechanical trouble. He escaped the crash-landing unhurt and duly arrived in Vaenga, only to suffer an eye injury in a friendly snowball fight!

More casualties were suffered during *Tungsten*, although not by RAF Spitfires. On 16 May 1944 Lt. Werner Gayko of 9./JG5, scrambled in a Bf 109G-6 from Svartnes, shot down a PR Spitfire, flying on a recce mission to Kirkenes. The pilot, *Kapitan* Viktor Vasilyevich Aleksandrov, OC 3 *Eskadrilya* 118 ORAP was killed. British personnel left for Britain on 31 May and all the aircraft were left at Vaenga. Essentially, only two serviceable Spitfires were taken over by the Soviets this time, but the

two damaged ones were still treasured as a source of spares. A VVS SF report dated 1 June 1944 stated that four Spitfires were on charge, at that time.

On 17 June 1944 (Soviet sources say 18th), *Starshiy Leytenant* Popovich was shot down in a PR Spitfire on a recce sortie over Kirkenes by Ofw. Walter Schuck of III./JG5. Popovich baled out safely and landed in Soviet-held territory. On 29 June 1944 a PR Spitfire was damaged by German fighters during a reconnaissance sortie to Varanger Peninsula. *Kapitan* I. A. Platonov force-landed this damaged machine at Pummanki Airfield, on the Rybachi Peninsula.

According to official records, on 12 December 1944 the VVS SF still had three Spitfire PR.IVs, and on 1 February 1945, just two.

Some Russian researchers claimed that the last Soviet Spitfire PR.IV, marked 'white 2', and carrying the name 'Mable'¹⁵ in Latin characters (evidently dating from the RAF service), was transferred in 1946 to the Northern Fleet Museum in Murmansk. This would be the only complete Spitfire PR.IV ever placed in a museum, although according to other Russian historians the Northern Fleet never had a museum!

The Soviets were the last to fly the Spitfire PR.IV operationally, as the variant was withdrawn from RAF service in February 1945.

¹⁵ When transcribed phonetically to Cyrillic, and then re-transcribed letter-by-letter to Latin again, the name becomes 'Meibl', and this spelling is sometimes found in publications.

PRESSURISED IMPOSTERS

F MARK VI (PR)

In 1943 680 Squadron in Egypt used five Spitfire F.VI(PR)s, serialled BS106, BS124, BS133, BS134 and BS149.

These had been delivered to Egypt as high altitude fighters, to intercept Luftwaffe Ju 86P-2 recce aircraft, operating at extreme altitudes. At that time, because of strong German air defence, RAF PR missions to Greece were flown at extremely high altitudes - rather painful for British pilots in unpressurised PR.IVs.

Since German bombers were almost non-existent over Egypt by 1943, the Spitfire F.VIs, originally sent to counter German PR aircraft, were themselves modified for the PR role. No. 103 MU at Aboukir carried out the modifications by removing the armament and installing vertical F8 cameras in the fuselage. The aircraft were used a few times over Greece and Crete in April and May of 1943 but were withdrawn by August that year. These improvised Spitfire F.VI(PR)s were the first pressurised PR Spitfires - a feature later used in PR.X and PR.XIX production versions.



Spitfire F.VI Trop BS124 'A' as a desert fighter, fitted with the large Vokes dust-proof filter, and finished in the desert scheme of Dark Earth and Middle Stone, with Azure or Light Mediterranean Blue undersurfaces. (Ricardo Lezon)



This Mediterranean hangar scene, believed to have been taken at no. 103 Maintenance Unit located at Aboukir in Egypt, includes a most interesting Spitfire in the foreground. The aircraft features the stubby nose which identifies her as a Mark number between I and VI. The late style fighter windscreen with integral bullet proof panel narrows the choice to either a Mk V or the high altitude Mk VI fighter. Finally, the pointed wing tips and the rounded triangular opening window in the port side of the windscreen leave no doubt that this is indeed the pressurised Mk VI. What is definitely non-standard for this variant, though, is the absence of armament in the wings, and the bulky tropical filter developed at Aboukir and usually retrofitted to Mk V Trop fighters. These two latter details mean that this is one of the five PR conversions of the pressurised fighter. These were the first ever photo reconnaissance Spitfires with pressurised cockpits. (P. Jarrett coll. via P. R. Arnold)

CITIUS, ALTIUS, FORTIUS¹⁶

NEXT GENERATION PR VERSIONS

The PR.IV was a turning point in the history of PR Spitfires. From this variant on, the arrangement of all principal components was set: cameras in the rear fuselage and integral wing fuel tanks. From then on development of PR variants followed the path of fighter versions; ie. ever more powerful engines were fitted to improve performance, especially service ceiling and top speed, in order to keep ahead of the latest German fighters.

So, when development commenced on new fighter Spitfires powered with Merlin 60-series engines, PR versions were a natural extension. Two new fighters were envisaged, the very high altitude Mk VII with pressurised cockpit (considered the main priority at that time), and the unpressurised Mk VIII. Both were to have PR variants and, as early as 21 April 1942, an order was placed for 70 recce aircraft, provisionally designated PR.VIII. These were to be based on the F.VIII and powered with the Merlin 61. Two short batches of serial numbers were assigned – LV643-681 and LV726-756. Eventually the Spitfires bearing these serials were completed as fighter LF.VIIIIs, with Merlin 66 engines.

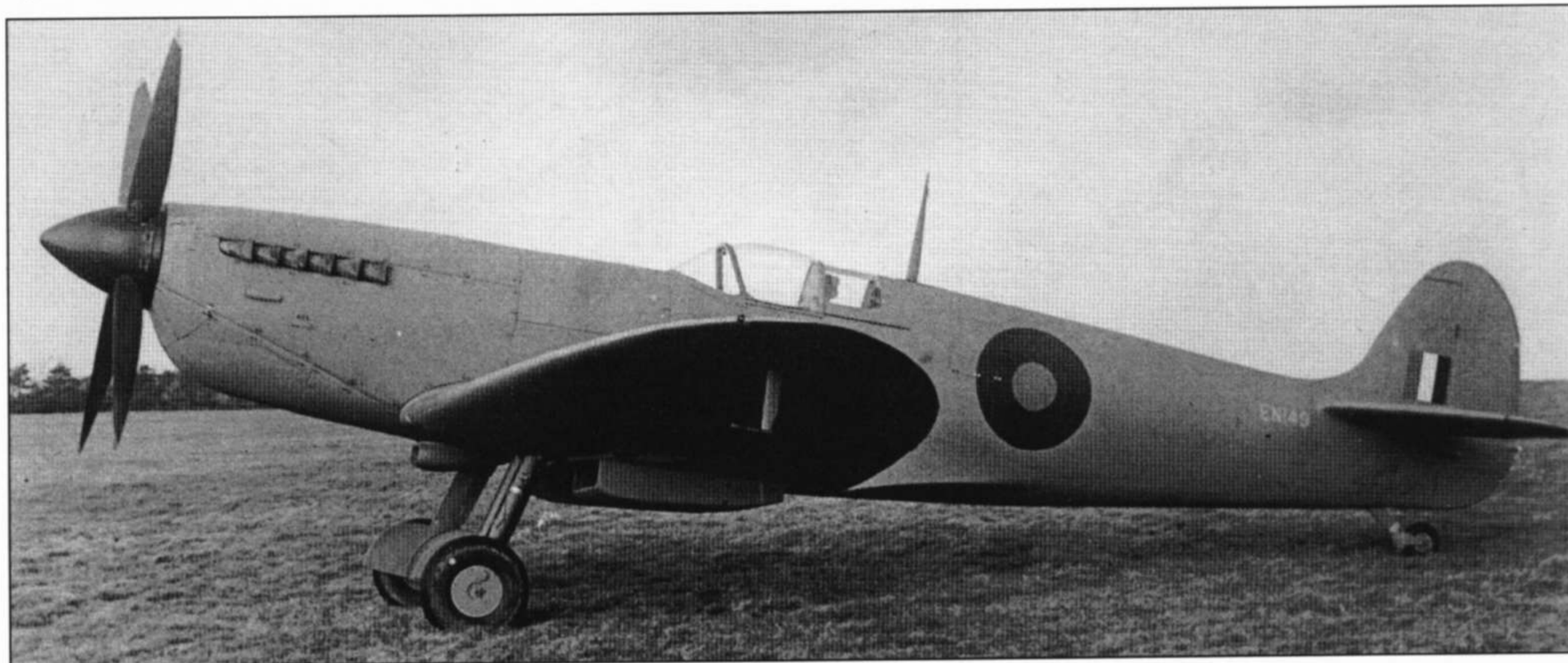
PR.IX AND XI

In the meantime, a policy change resulted in the pressurised PR variant derived from the F.VII being renamed PR.X, while the Spitfire F.VIII-based variant project became the PR.XI. Prolonged development of the pressurised cockpit caused delays in the F.VII and PR.X programmes. Work on the F.VIII, which was to feature the same substantially redesigned and strengthened fuselage, was also falling behind schedule. Eventually, the first production Spitfire with a 60-series Merlin was the F.IX, a simple modification



USAAF Lt Robert Kraft stands beside Spitfire PR.XI, PL962, in October 1944. Unusually, it seems that the aeroplane is coded 'LY'; this was the code for 1 PRU, which officially ceased to exist before the first PR.XIs were delivered! PL962 was built in late 1944 and served only with 14th PS 7th PG USAAF, lost on operations on 15 January 1945, when Lt. James F. Tostevin failed to return from a mission to Berlin. (via P. Ludwig)

EN149, one of the 15 Spitfire F.IXs hastily converted to PR.IXs by fitting photographic equipment and an enlarged oil tank. These aircraft did not yet have the wing integral fuel tanks installed and for long-range missions they had to carry additional external tanks. These aeroplanes were similar in appearance to early production PR.XIs, and are often confused with them. The fixed tailwheel is the give-away for these hasty Mk IX conversions. Note the absence of a headrest (by that time this was not fitted in Spitfire fighters). (via P. R. Arnold)



¹⁶ This Latin saying, widely known as the Olympic motto, means 'faster, higher, more powerful', quite fitting for the tendencies of PR Spitfire development.



of the Mk V. For the PR role, not subjected to the excessive g-forces of dog-fighting, there was no need for major structural strengthening, so a decision was taken to develop the PR.XI from the F.IX by incorporating the necessary PR equipment, as well some already designed refinements intended for the F.VIII.

Before the PR.XIs were produced, an old Heston Flight trick was used. A number of fighter Spitfire F.IXs were modified by simply removing their armament and installing photographic equipment, similar to that of the PR.IV. At least three existing Spitfire IXs - BS338, BS339 (F.Vs converted to F.IXs at Rolls-Royce Hucknall) and BS473 - were equipped with camera systems during October 1942, at Vickers Armstrongs' Worthy Down facility. The first of these, BS338, was delivered to 541 Squadron at Benson on 30 November 1942. On that very first day it flew a mission to Boulogne and subsequently, 15 Spitfire Mk IXs were similarly converted on the assembly line. Probably all of these featured the enlarged oil tank under the nose, but they lacked the 'wet' wing tanks and employed drop tanks to extend their range. These aircraft were designated PR.IX (factory designation type 374). BS497 was the first of these and first flew in November 1942. PR.IXs came from a mixed batch of several Marks (F.V, F.IX, PR.IV, PR.IX) assembled in parallel and were completed together with the last PR.IVs (subject to engine availability). Apart from the 15 converted F.IXs a single PR.IV (EN263) was modified to PR.IX standard, apparently.

Mike Horsfall about to photograph F/Sgt D. W. Jolly Jolliffe in front of MB953 'H' at Melsbroek in September 1944. Note that, typical for the mid-production PR.XIs, MB953 featured the early style spline oleos and five-section wheels, but the later Mk XII-style broad chord pointed rudder. Note sortie markings under the cockpit. (J. Taylor)

Ron Abrahams (left) and Ron Parnell in front of MB953. It was Ron Parnell who painted the 'I Spy' motif, at the request of F/Lt Eric Martin. (R. Abrahams)



Parts of a Soviet Spitfire PR.IV, believed to be that of Kpt. I. Yelkin. Note at the lower right in this photo, with stencil "PORT", is a Mk Vb cannon bay cover. Just possibly, this Spitfire was a Russian Mk Vb conversion, or, more probably, a PR.IV repaired with Mk V parts. © Peter R. Arnold



Part of the starboard engine cowling with the red star. © Peter R. Arnold



A portion of the port wing and the bent propeller of the same Spitfire, displayed at the aeronautical museum at Bodo in Norway. Note the remains of a red star, and several different hues of blue and green noticeable on the bottom of the wing. © Anatol Olak





A Mosquito PR.XVI of 60 Squadron SAAF 1944. Although based in Italy, they ranging as far as Germany, hence the wearing of "D-Day" stripes. The red and white tail stripes were added to Mosquitos in Italy because the type was confusingly similar in profile to the Luftwaffe's Me 210 and Me 410s.

Mosquito was the other principal PR type in RAF and Commonwealth service, complementing the Spitfire where longer range was required. At times the two types competed in the eyes of RAF decision-makers.

(R. Buchanan)

The most famous PR.IX missions involved preparations for 617 Squadron's famous Dambuster raid against the Ruhr dams. In January 1943 reconnaissance was carried out with maximum secrecy, to avoid anything that might raise suspicion on the German side. On 15 May F/O F. G. Fray took the last pictures of the Möhne, Sorpe and Eder dams, in a PR.IX, prior to the attack. The night of May 16/17 brought the Dambuster raid and in the early morning of 17 May, eight hours after the strike, Fray was there again to photograph the result¹⁷.

During February and March 1943 the first PR.IXs entered service with units in the Mediterranean, EN153 being the first to reach Malta. Eventually, all these PR.IXs would be converted to PR.XI standard.

Production of true PR.XIs suffered another delay owing to a dispute over RAF PR doctrine. Because the new PR Spitfire was delayed, the Air Ministry proposed early in 1943 (exactly at the time when production was starting) that all PR squadrons convert to de Havilland Mosquitoes. After analysing the question, the Air Staff agreed that Mosquito could perform 90% of missions; so Spitfire production for only 10% of PR units was mooted. At that stage however, Air Marshal Slessor, head of the Coastal Command that controlled the PR units, entered the argument. He pointed out that the Spitfire was smaller than the Mosquito, used half the number of Merlin engines, was faster, more manoeuvrable and quieter, so he felt production should be increased, not reduced.

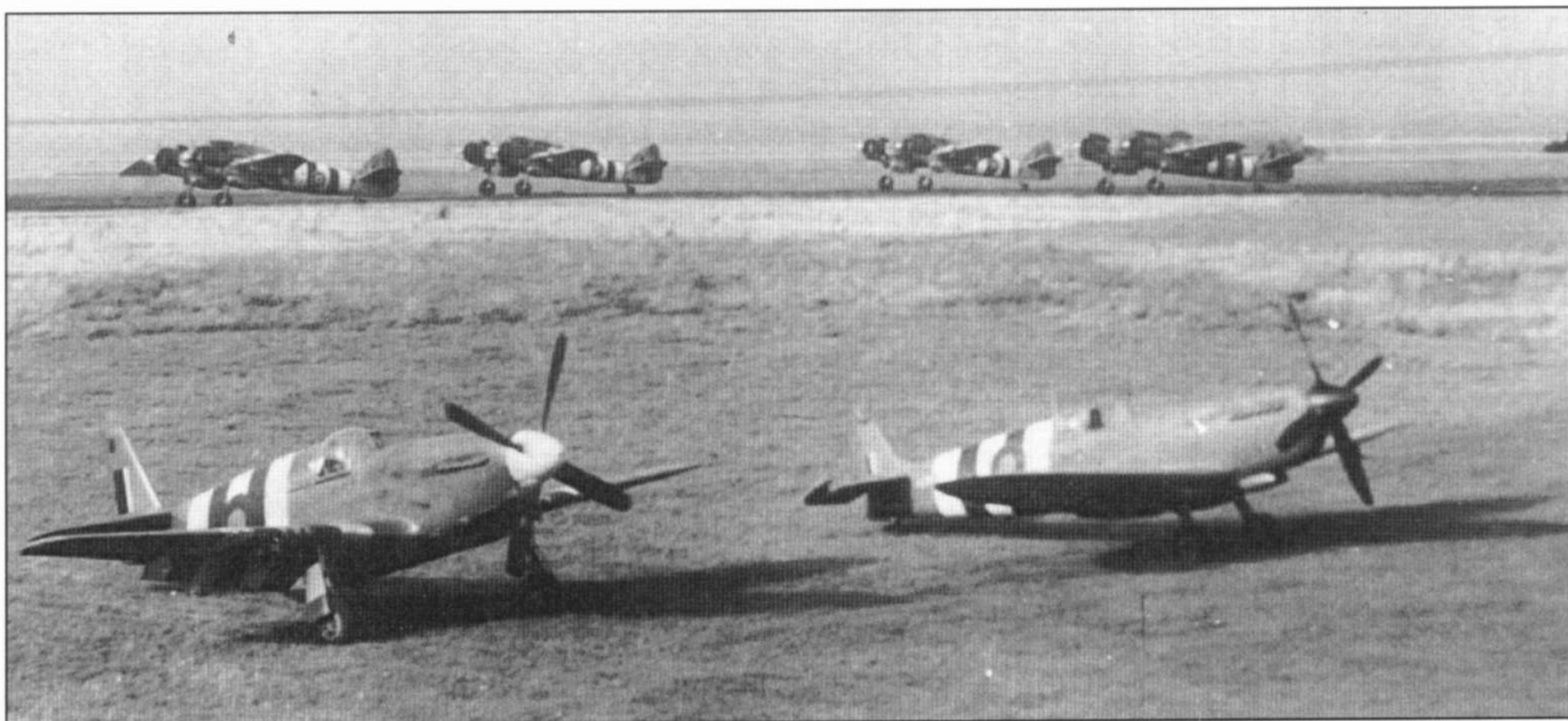
The Air Staff finally decided that PR.XI production should be accelerated at the cost of fighter Spitfires, which illustrates why true PR.XI (Supermarine type 365 in standard and type 370 in tropicalised form) production commenced using complete Mk IX airframes (serials EN341-343 and EN652-685). The PR.XI featured wing fuel tanks

like the PR.IV and a 14.4gal oil tank in a 'chin' similar to that of the PR type F. Early production PR.XIs featured the classic rounded rudder, but later ones had the pointed version. A retractable tailwheel, one of the F.VIII refinements, was fitted as standard. 60-series Merlins (either 61, 63 or 63A; 260 aircraft) or the high altitude Merlin 70 (211 aircraft) was the power plant, driving a four-blade Rotol type R3/4F5/2, R3/4F5/3, R5/4F5/5 or R12/4F5/4 propeller. The Spitfire XI was the first PR variant to be equipped with negative-g resistant carburettor as standard. All the Merlin 70-series powered aircraft, and 198 of those with 60-series Merlins, were fitted with a Vokes Aero-Vee dust filter, which could be easily be recognised by the larger and longer carburettor air intake. All those with 60-series engines featured the fuel cooler in the port wing leading edge. Higher fuel consumption by the more powerful engine resulted in the Spitfire PR.XI's maximum range being 1,360 miles (2,190km), a reduction compared to that of the PR.IV.

PR.XI aircraft were fitted with either a TR.1133 or TR.1143 wireless set with beam approach facility. The universal photographic installation offered for the first time, an option of two F52 cameras with 36in. focal length lens. Those PR.XIs used for tactical reconnaissance featured an additional camera under each wing.

The usual photographing technique with vertical cameras was:- an approach to the target as if to miss it by a small distance; a 90° turn to fly straight over the target, first photo; 90° bank over wing to check position relative to the target line, another photo; etc. When taking photographs with the fuselage oblique camera the flight would continue parallel to the target line, with the target visible behind the wing exactly in line with a white sighting mark painted on the aileron.

¹⁷ Notably, on 29 April 1943, the first test drop of the bounce bomb was done by none other than Vickers test pilot Maurice 'Shorty' Longbottom! Sadly, he was killed shortly after the war while testing the Vickers Warwick GR.II.



During 1943 Spitfire XIs replaced the PR.IV in Britain. During early operations a new problem was encountered, which had not occurred on previous PR Spitfires - cockpit canopy icing. The external surface would ice during starboard turns, when vapour from the air compressor cooling duct was directed straight onto the canopy. No modification was necessary, however, since the ice would soon come off after setting a straight course. Much more dangerous was the internal icing which tended to build up during long flights at altitude. From the PR.IV onwards the cockpit was heated by hot air from the engine cooling system. The system worked perfectly in the earlier Spitfires, but in the PR.XI, when flying at optimum cruising speed, it refused to build up enough heat. The reason turned out to be quite simple in that the Spitfire PR.XI, like all Merlin 60/70-powered versions, featured a more complex cooling system. When the engine was running at low revs a single radiator section was enough. So, a thermostatic switch was installed, to turn off the starboard radiator under such conditions. By an unfortunate oversight, the starboard radiator was the one that fed the cockpit with warm air. Pilot complaints, however, resulted in a modification - the thermostat was moved to the port side and comfort was restored!

Spitfire PR.XI, probably in June-July 1944. The Mustang parked next to it might be one of the three aircraft of the type used by 541 Sqn at the time. (B Davidson)

Spitfire PR.XI MB 950 about September 1944. The outer wings show the typically faded appearance of the original factory-applied PRU Blue after prolonged service, while the inboard portions have fresh paint where the invasion stripes have been removed. This is a very good example of how much PRU Blue would fade. (P Ludwig)

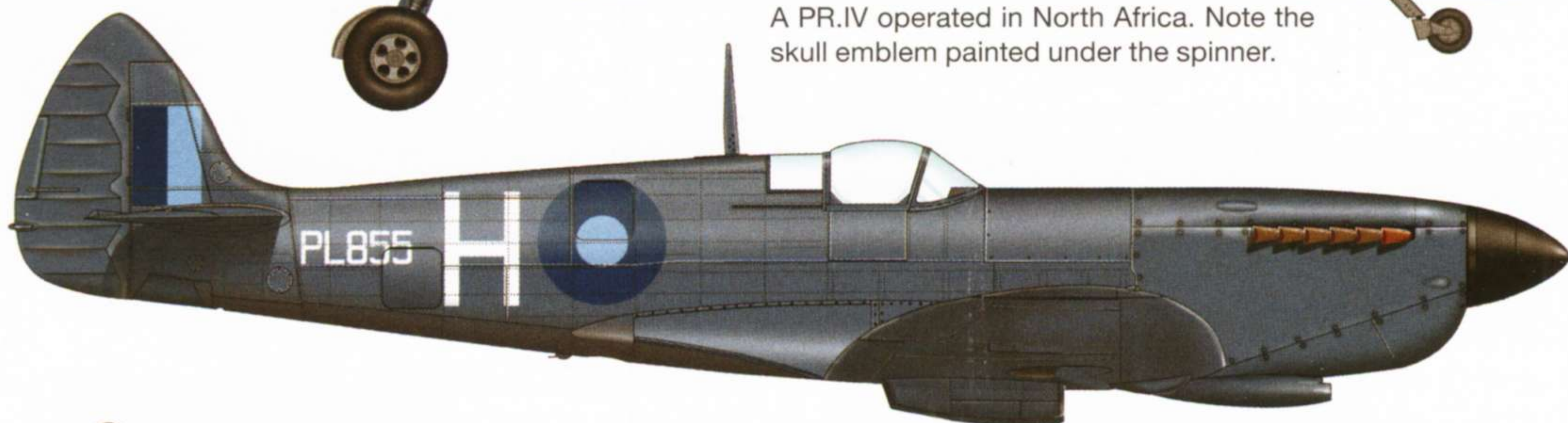




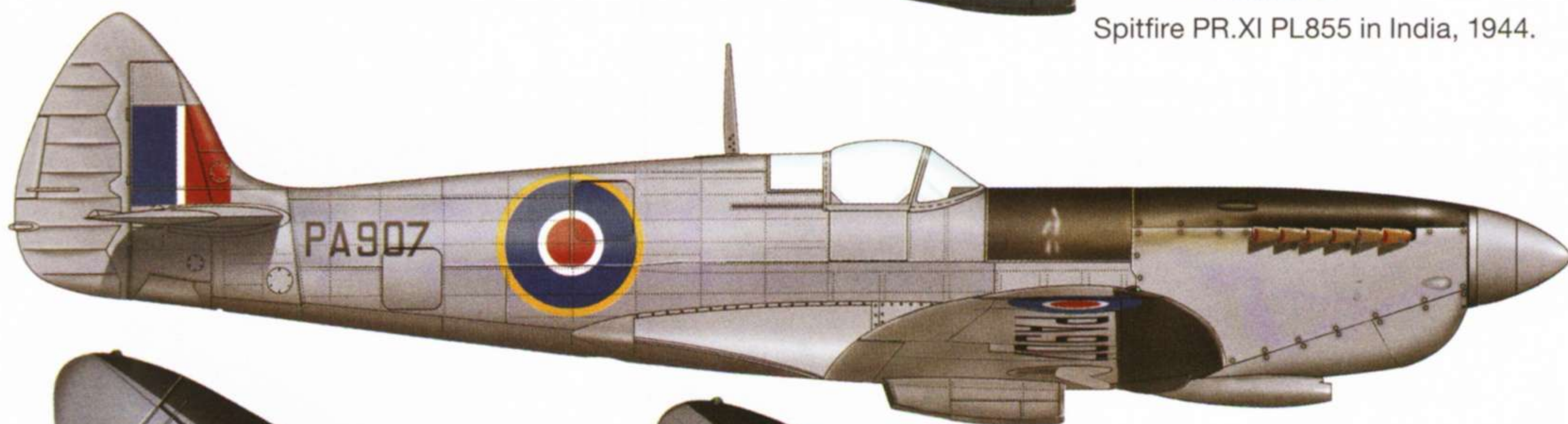
Spitfire PR type C X4385 was one of the first machines delivered to No. 3 PRU when it was formed to operate solely for Bomber Command. It was lost on 22 September 1941 during a mission to Hamburg.



A PR.IV operated in North Africa. Note the skull emblem painted under the spinner.



Spitfire PR.XI PL855 in India, 1944.



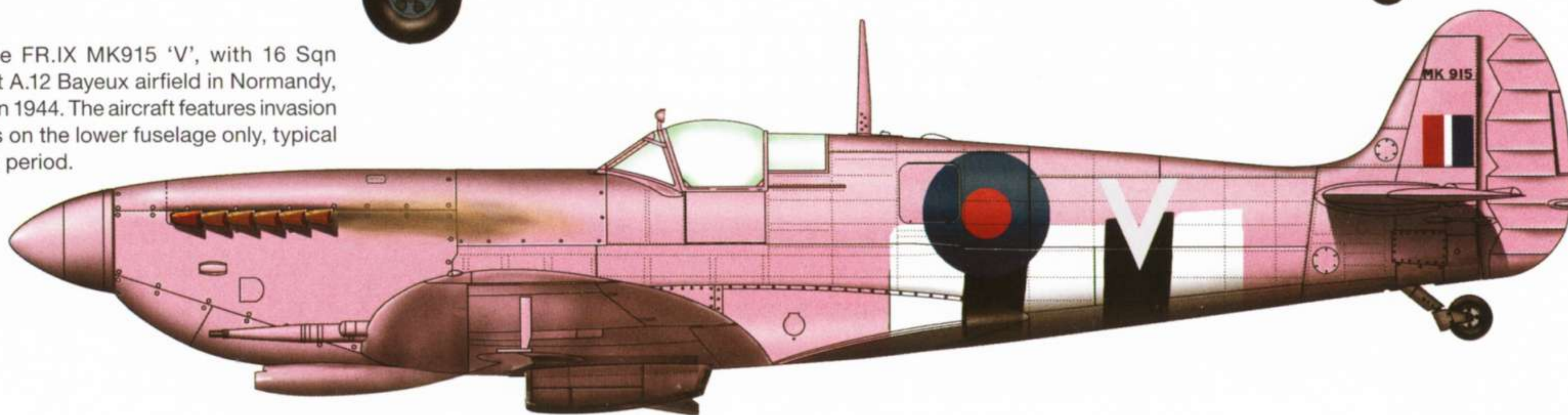
This Spitfire PR.XI, PA907, appears to have a small piece of nose art on the fuselage, just forward of the windscreen (see page 57).



From the left: Sgt. Ron Abrahams, Sgt. Ron Parnell, and F/Lt Eric Martin with MB953 of 16 Squadron. This Spitfire PR.XI featured the "I Spy" motif on the cowlings and mission log under the cockpit (R. Abrahams)



Spitfire FR.IX MK915 'V', with 16 Sqn RAF at A.12 Bayeux airfield in Normandy, autumn 1944. The aircraft features invasion stripes on the lower fuselage only, typical for the period.



INVASION PLANNING

1943 brought about reorg-anisation within the RAF, as preparations for the liberation of Europe gathered pace and this affected the PR units. On 1 June 1943 the Army Co-Operation Command was reformed, within the 2nd Tactical Air Force (2 TAF). Until then the only specialised PR unit within the ACC was 140 Squadron which, at that time, used just four Spitfires and a Mosquito – all borrowed from Benson. After the reorganisation, 2 TAF would have 34 PR Wing with two squadrons: 16 Sqn (a flight each of Spitfire PR.XIs and Spitfire FR.IXs) and 140 Sqn (which converted completely to Mosquitoes on 10 April 1944); and two tactical PR Wings – Nos. 35 (including 4 Sqn flying PR.XIs) and No.39 Canadian Wing (with 400 Sqn on PR.XIs).

Group Captain P. Ogilvie took command of 34 PR Wing (he would fail to return from a sortie over the North Sea in December 1944). Well after the invasion – on 9 September 1944 – 34 Wing moved to France.

On 26 June 1943 a further reorganisation of the PRU units took place. They were reformed into 106 PR Wing, under Air Commodore John Boothman¹⁸. On 18 October 1943 Squadron was disbanded and its A Flight divided among 541 and 542 Squadrons. Its B Flight was reformed into 309 Ferry Training and Aircraft Dispatch Unit to train ferry pilots for PR aircraft. This left two PR Mosquito (540 and 544) and Spitfire (541 and 542) squadrons with 20 aircraft each. 106 Wing included 540, 541, 542 and 544 Squadrons, No.309 FTADU and No 8 OTU (at Dyce).

¹⁸ Prior to the war he participated in the Schneider Trophy contests which he won in 1931 in a Supermarine S.6B floatplane, an early predecessor of the Spitfire.



Major Walter Weitner, C.O. of the 14th PS, and his Spitfire PR.XI PA892 *High Lady*, in which he flew the USAAF's first photo reconnaissance mission to Berlin, on 6 March 1944. A colour illustration of this Spitfire appears in *Classic Warbirds No.4*. Note the patched-over fuel cooler air intake in the port wing root, indicating the photo was probably taken during winter. (USAAF via P.Ludwig)



Lt. John Richardson flew the 7th Photo Groups 2,000th mission in a Spitfire and here his Crew Chief, Earl Peterson, congratulates him. D-Day stripes and the exhaust stain are apparent. (via Paul Ludwig)



An early production PR XI, with the small carburettor intake, flanked by two PR IVs in North Africa. Note the skull emblems painted under the spinner on both the PR IVs. (R. Buchanan)

The 7th Photographic Group of the US 8th Air Force, based at Mount Farm near Benson, was tasked to carry out aerial reconnaissance for the USAAF. Analysis of photographs from both 106 PR Wing and the 7th PG was carried out by the Allied Central Interpretation Unit. On 15 May 1944 106 PR Wing and the ACIU were united into 106 PR Group. This remained within Coastal Command although the changing war situation and the forthcoming end of hostilities brought about changes in 106 PR Group's structure. The Leuchars (Scotland) detachment was disbanded in April 1944; that at St Eval (Cornwall), on 20 July; and at Gibraltar, in August.

Between October 1943 and March 1945 the 14th Photographic Squadron of the 7th Photographic Group USAAF, under Major Walter Weitner, used Spitfire PR.XIs leased from the RAF. When the war in Europe ended, the Spitfires were returned as were all other British aircraft in USAAF service.

October 1943 saw the beginning of the intensive search for V1 launch sites all over western Europe. Since the beginning of 1944 most of the PR effort was aimed at collecting data for the invasion. Immediately prior to the Operation 'Overlord' an unusual mission was carried out. In order to mislead the Germans that the invasion would be at Calais, a decoy invasion fleet was assembled at Dover. 106 Wing aircraft photographed the mock-up ships from various angles in order to verify their realism and on 5 June, RAF fighters 'failed to intercept' a German PR sortie.



In late February 1945, 10 Mosquitoes and 10 Spitfires from Benson were used to form 104 PR Wing at Coulommiers, the same base used by the 'Cotton's Circus' in the spring of 1940.

PR.XIs TO THE MED

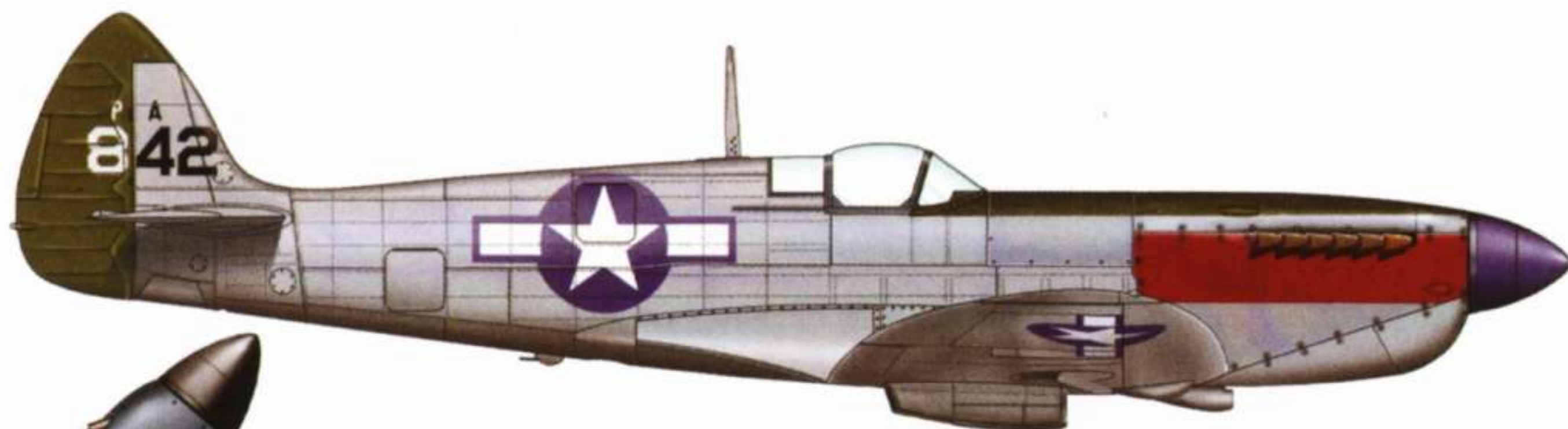
In March 1943 deliveries of Spitfire PR.XIs to Malta and the Middle East commenced. They would supplement, then replace the PR.IVs. Ferry flights to Gibraltar and Malta brought losses – not always due to enemy action. On 5 May 1943 EN419 landed at Furadouro in Portugal, where it was interned. At the same time and in the same region, MB782 went missing. In the summer 1943 more than 20 PR.XIs were delivered to the Mediterranean. After the North African campaign, Sicily invasion and finally the landing in Italy, a serious reorganisation took place in the PR forces in the Mediterranean.

On 1 October 1943 Adrian Warburton was posted as OC of 336 PR Wing based at La Marsa. The wing comprised 682 and 683 Sqns (10 Spitfires each) and 680 (Mosquito¹⁹) Sqn RAF and 60 Sqn SAAF with Mosquitos. However, 'Warby' was destined not to take command of the unit, for he was seriously injured in a car crash and had to give up flying for a long period²⁰. It was Gordon e Hughes²¹ who replaced him as 336 PR Wing's commander. Soon after the Wing moved to San Severo, Italy.

19 C Flight of 680 Sqn was equipped with Spitfire PR.XIs and based in Egypt at that time.

20 On 12 April 1944, after a prolonged recovery in UK, Adrian Warbuton left Mount Farm in a PR Lockheed Lightning, heading for San Severo. He was last seen over Bodensee. The mystery of his disappearance has been solved only very recently.

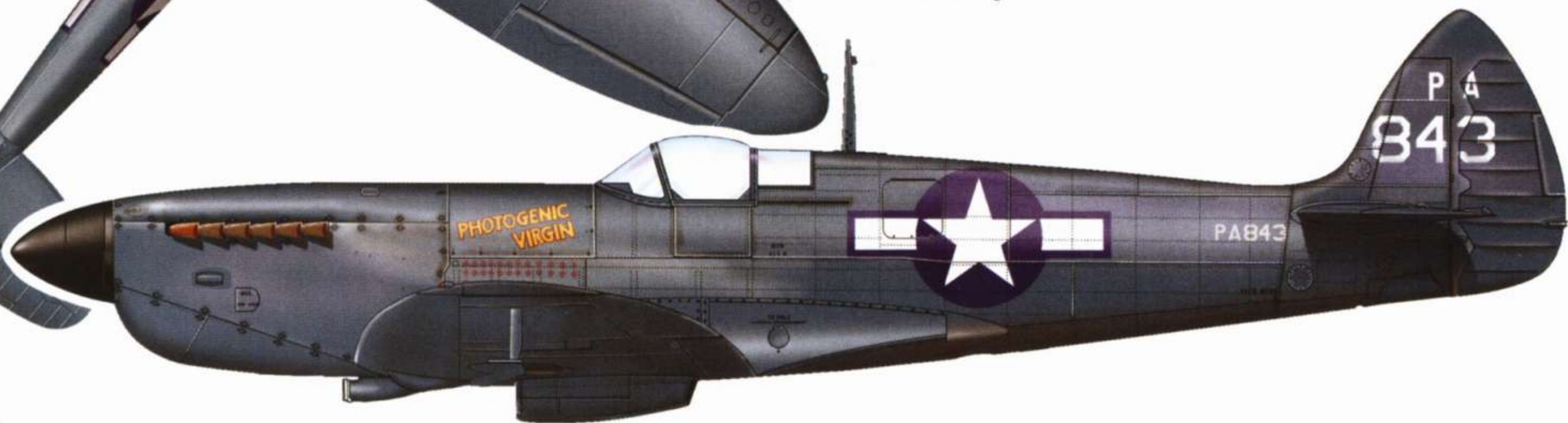
21 1 PRU veteran and individualist, Hughes would sign his name with the lower case middle 'e', and his personal aircraft carried an 'e' painted on the cowling. When, after sinking of 'Bismarck', her accompanying cruiser 'Prinz Eugen' disappeared, it was Hughes who found the latter and photographed her at Brest on 3 June 1941 flying Spitfire I type G X4944 (the photo of which appears in Classic Warbirds No. 1). On another occasion, when returning from a dicing sortie, he made a detour to find and photograph a creek near St Nazaire on request of an Air Marshal who had left his yacht there in 1940!



PA842 was a Spitfire PR.XI operated by the 14th Photo Squadron, March 1945, by which time the Army Air Force had removed the camouflage from its Spitfires. Note that the canopy frame is still PRU Blue. (see *The Mighty Eighth in Color*, By Roger Freeman)

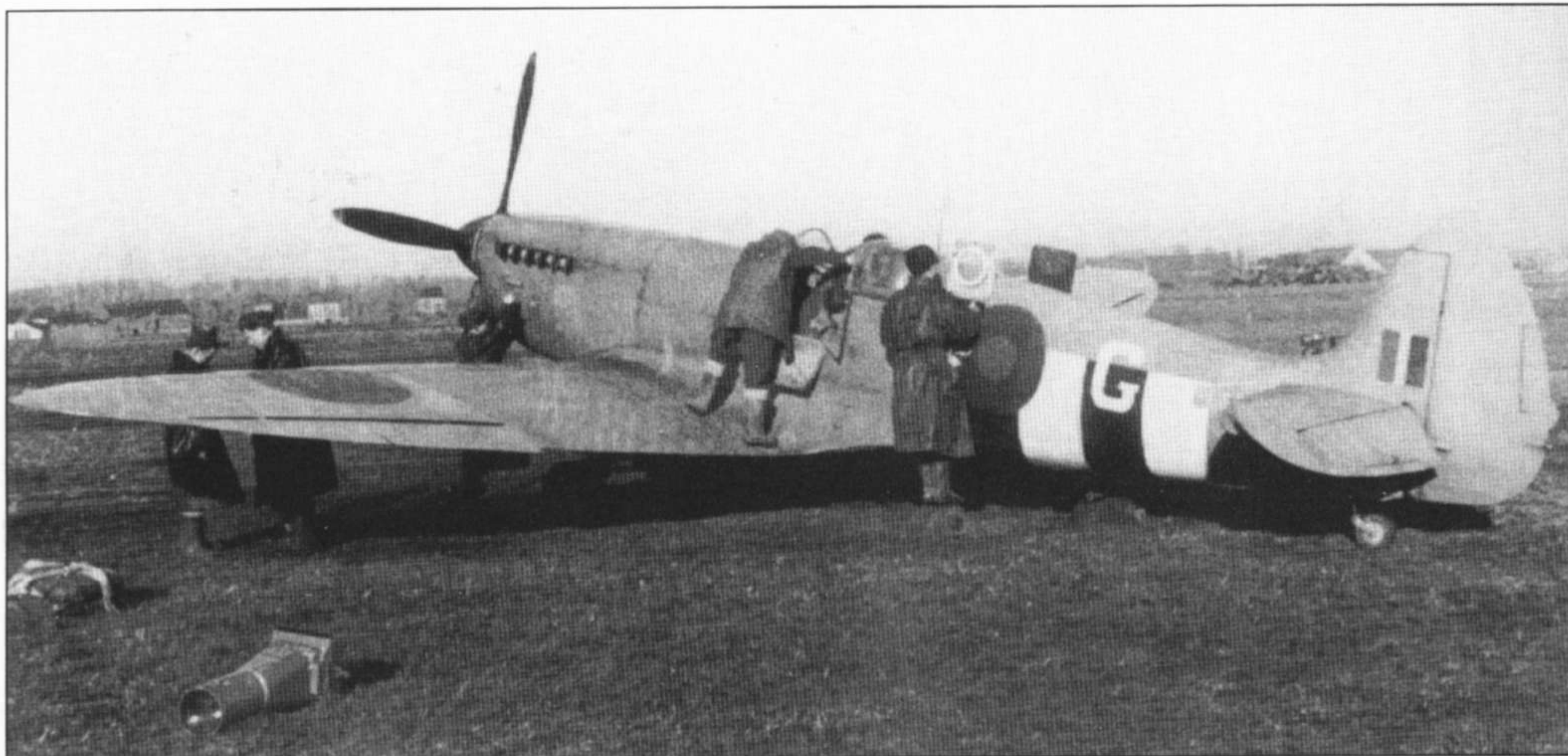


Spitfire PR.XI PA843 was operated by the 14th Photo Squadron in March 1945. It had virtually "as new" paint-work, including a full set of RAF stencil markings.



Either EN671 or EN677, this PR.XI basking under Italian sun in 1944 shows to advantage the real looks of the PRU Blue. In fact quite a few blues, depending on how faded/refreshed/soiled/cleaned was the finish. If seen in black-and-white, colours of this machine could easily pass for disruptive camouflage! Typically for all Spitfires (but particularly those operating at high altitudes) upper wing surfaces and the fuselage spine aft of the cockpit show extensive fading. It looks like the latter area was largely retouched as far up as could be reached by a man standing on the ground or on the wing root. However, the fresher paint must have been applied with the canopy slid back, resulting in a vertical strip of pale finish left immediately aft of the cockpit glazing. The cowlings and central section of the fuselage show extensive exhaust residue, as well as streaks of fuel spills. It was typical for the entire nose, and the sides of the fuselage as far aft as the wing root fillet, to be covered with thin film of oil sprayed from the propeller pitch control mechanism. The walkway on the wing root is so worn that natural metal shows through. Note the USAAF Beaufighters in the background. (via T. Kopański)





By now PR aviation was no longer the mysterious “game” from ‘Cotton Club’ days, and had become more and more like any other branch of the RAF. However it still retained some eccentric characters within its ranks whose attitude towards military drill was, shall we say, unorthodox - *for example, S/L Morgan, a Spitfire pilot of 336 Wing, used to write his mission reports in verse!*

At the end of 1944 Spitfire PR.XIs of C Flight 680 Sqn, based at Payne Field in Egypt, were used for PR work during the communist rebellion in Greece. From December 1944, one of the unit's Spitfire XIs was detached to Hassani airfield near Athens. It is interesting to note that the post of Air Officer Commanding in Athens at that time was held by Geoffrey Tuttle.

PR.XIs TO INDIA

In late September 1943, the first two PR.XIs (EN679 and MB889) were delivered to the Far East and on 7 October W/Cdr Wise flew the first sortie. However, PR.IVs remained the backbone of 681 Sqn, which on 16 October 1943 was split into two separate units: 681 remained on Spitfires and 684 received twin-engine B-25C Mitchells and Mosquitos. On 28 November F/Sgt Hain in AA793/F, failed to return from a mission to Indaw.

At the end of May preparations were under way to airlift wounded Chindits from the Indawgyi Lake area. In spite of the coming monsoon period, F/Sgt R. K. Brown flew MB891/A on 30 May to take photos of the lake, followed the next day by W/O R. Monkman, in PA934/T. Their work contributed considerably to detailed planning of the operation, and during the next few days two Short Sunderland flying boats rescued nearly five hundred sick and wounded Chindits.

In early 1945, 681 Sqn Spitfires carried out tactical reconnaissance of southern Burma with Gokteik Viaduct the target once again. This time the aim was to find out if it could be used during the Allied offensive. News was received that the Japanese had damaged the viaduct on 17 March, but the degree of destruction was not known. On 21 March 1945 F/Lt Gadd of 681 Sqn flew MB911/Y to photograph the site, but his Spitfire was damaged on the way back and Gadd was forced to land at Monywa. However, he returned to Alipore in

Spitfire PR.XI PL830 ‘G’ of 16 Squadron during the summer of 1944, A12 airfield at Bayeux in Normandy. Note the open hatch of the photographic compartment, aft of the cockpit and the F52 camera on the ground. Note also the difference in colour between the faded outer wing portion and the inner part, where invasion stripes have just been overpainted.

The tendency of PRU Blue to fade considerably has resulted in theories about PR Spitfires (PR.XIs in particular) being painted in ‘two-tone’ schemes with ‘Medium Sea Grey’ on upper surfaces. As far as can be ascertained no such schemes existed (although some authors would probably be prepared to argue that outer wing panels of the Spitfire here were painted MSG). (J.Taylor)



another aircraft and his photos showed that the viaduct was almost completely destroyed. However, this failed to stop the British driving the Japanese from the area and a week later an historic meeting took place with Chinese forces attacking from the north.

After the surrender of Japan in August 1945, extensive activities were undertaken to ascertain whether the Japanese forces were actually laying down their arms. Ten days after the surrender a 681 Sqn Spitfire took one of the most moving photographs in the history of PR aviation - a picture of Allied soldiers at Kanchanaburi PoW camp in Thailand, cheering and greeting the aircraft.

PR.XI MARKINGS

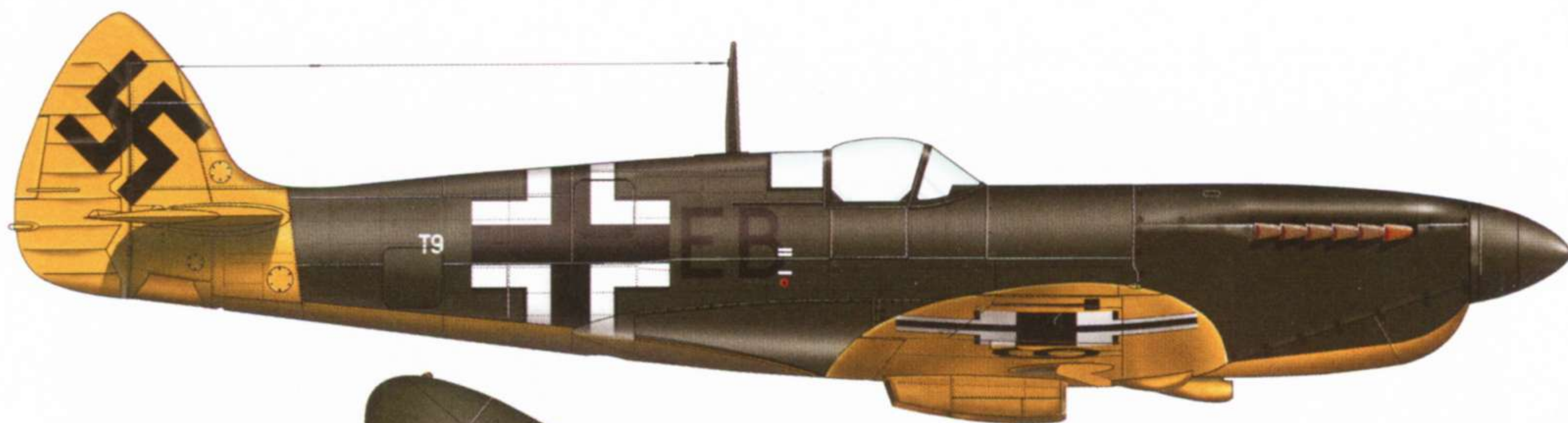
Spitfire PR.XIs used by the RAF during the war were painted PRU Blue overall, with no known exceptions. Spinners were generally black although some sources report a dark shade of blue (Roundel Blue, perhaps?). In Europe, standard PR markings were carried, albeit without unit codes. In the squadrons formed from the PRU (541, 542 and 544) the aircraft codes were usually painted below the serial and in characters of the same size (4"). Aircraft in other squadrons (western Europe, Mediterranean and the Far East) usually carried larger codes and their serials were often in the 8" fighter size. Codes and serials were usually in *Medium Sea Grey*, although sometimes white (codes especially), or black (serials especially) were used. In the Far East, SEAC (South-East Asia Command) style national markings were applied - i.e. smaller blue/light blue or blue/white roundels. The codes and serials were sometimes repainted light blue as well.

Spitfires of the 14th PS, 7th PG USAAF usually operated in the standard RAF camouflage, but with American star-and-bar

A Spitfire PR.XI about September 1944, sitting on PSP (Pierced Steel Planking). (R.Bracken)

Captain Gerald Adams, CO of the 14th PS since 16 February 1945, and his Crew Chief Carl Nordsten stand next to a bare-metal 7th PG Spitfire PR.XI in 1945. (P. Ludwig)

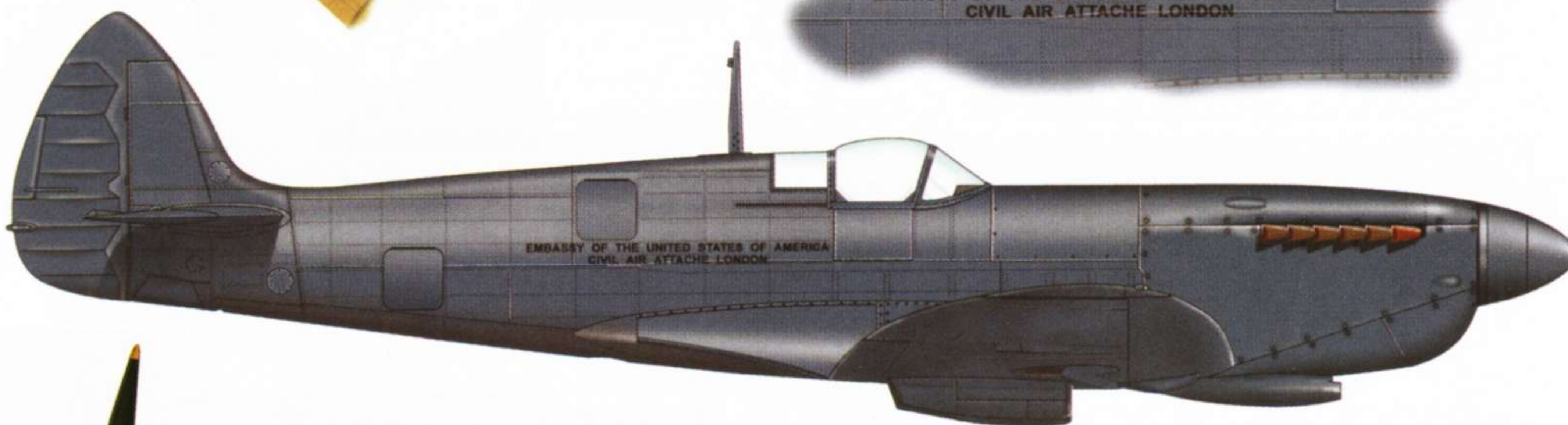
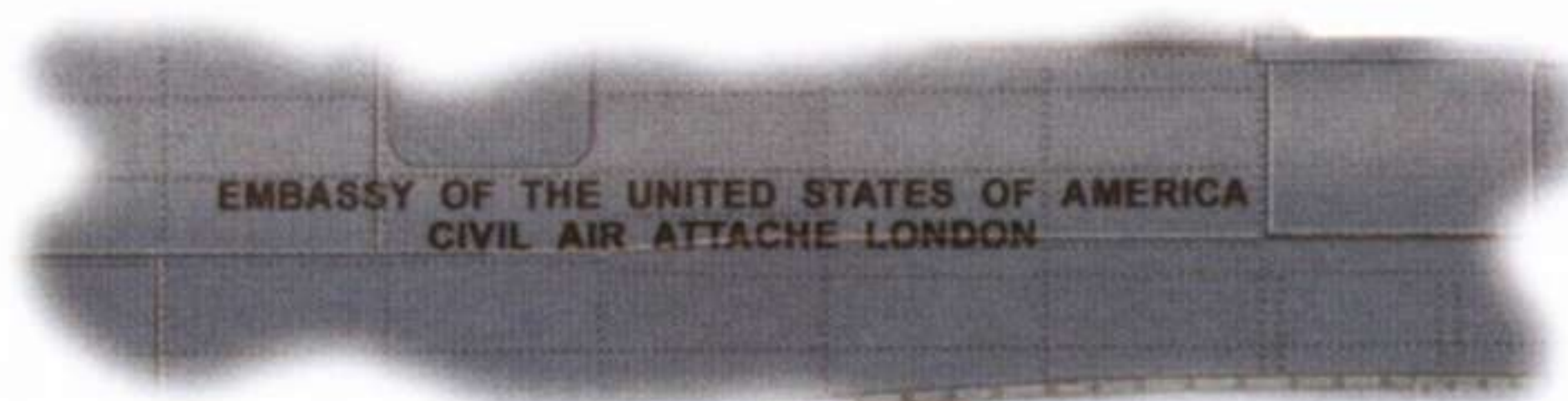




This Spitfire PR.XI was captured by the Germans and used in the Versuchsverband Oberkommando der Luftwaffe (Experimental Unit of the Luftwaffe HQ). See page 49 for more information.

The identity of the Spitfire is still a mystery. Authors mention two PR.XIs serving with the Cirkus Rosarius: T9+BB and T9+EK. Known photos show that the "EK" was applied on top of an overpainted earlier code, so both could well be one and the same machine.

According to the respected "Spitfire International", T9+EK was EN685, lost by the RAF in May 1944.



Spitfire PR.XI, civil registration N74138, ex-PL983, used by the Civil Air Attaché, US Embassy, London.



A Royal Danish Air Force Spitfire PR XI, 42-453.



Above. 'A-ZB' in service as a technical airframe at Kjevik air base in the late 1950s. It still wears the Norwegian applied blue colour in which the Norwegian Air Force operated the PR.XIs. This was a 'bluer' blue than the RAF's PRU Blue. (S. Meum)

The illustrations on this page show PR.XI PL979 'A-ZB' as it appeared in the early 1950s. The shade of blue is close to FS 25177 (per S. Meum)



markings in four positions (fuselage plus above port and below starboard wings). Later, the serial in large characters on the fin and rudder was introduced (6in letters above and 12in. digits below), and the spinner was in the Flight colour (white or yellow). Late in the war a new 7th PG marking was introduced - a large red rectangle under the exhaust and a dark blue propeller spinner. The rudder on 14th PS Spitfires was painted a shade of green (probably Olive Drab) as the squadron marking. By that time some American Spitfires flew in a natural metal finish, retaining only an anti-glare panel of Olive Drab or PRU Blue in front of the cockpit.

At least one Spitfire PR.XI was captured in undocumented circumstances and subsequently flown by the Luftwaffe. It was flown by the *2nd Staffel Versuchsverband Oberkommando der Luftwaffe* (2nd Flight of the Luftwaffe High Command Experimental Unit) or *Zirkus Rosarius* (*Rosarius Circus*) - after the name of the unit's leader.

The PR.XI remained the principal PR variant in RAF service until the end of the war. The pressurised PR.XIX entered service just before the end of hostilities in Europe, when some were delivered to 16 Squadron on the continent in early 1945.

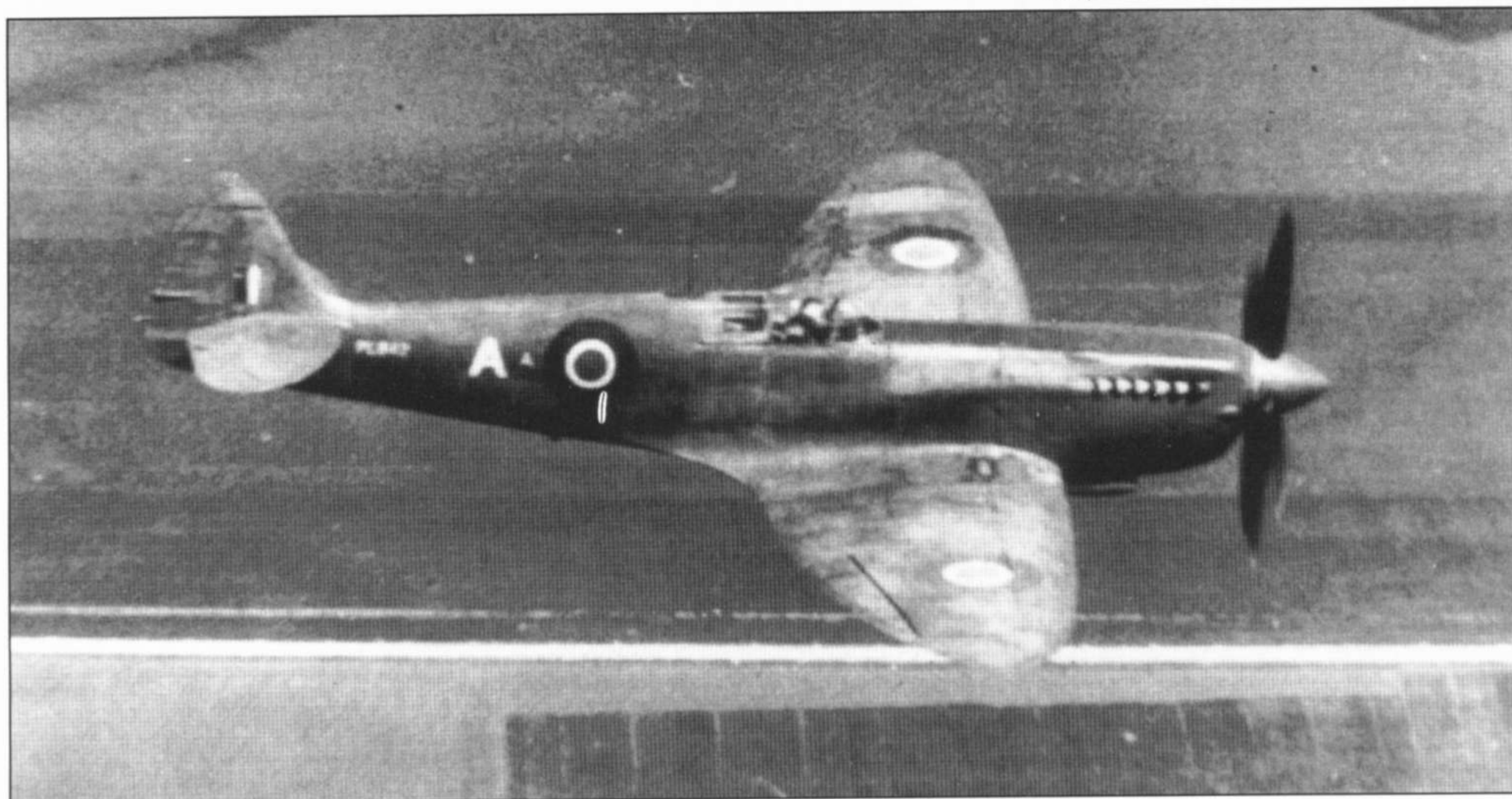
Interestingly, F/Lt H. J. S. Taylor of 16 Sqn said in a letter to the author...

'The Spitfire PR.XIX was used operationally in 1945. 16 Squadron received six in March 1945, but although they were very fast, it seems that the pilots preferred the PR.XI, which had much tighter turning-circle and could therefore defend itself quite well against the Me 262. The XI could turn endlessly into the Me 262 until the latter ran out of fuel and had to break off the encounter. I was once chased by an Arado 234, which played a cat-and-mouse game with me, zooming



A PR.XI "somewhere over Europe"
Note the rare, white outlined code letter. (P Arnold)

Spitfire PR.XI PL842 of 682 Sqn. being piloted by Wing Commander Roy Buchanan, over Italy immediately post-war. This photograph illustrates just how worn the PRU Blue finish could become. Note the small code letter 'A' between the full sized one and the fuselage roundel, and that the C-type roundels were carried in six positions. (R.Buchanan)



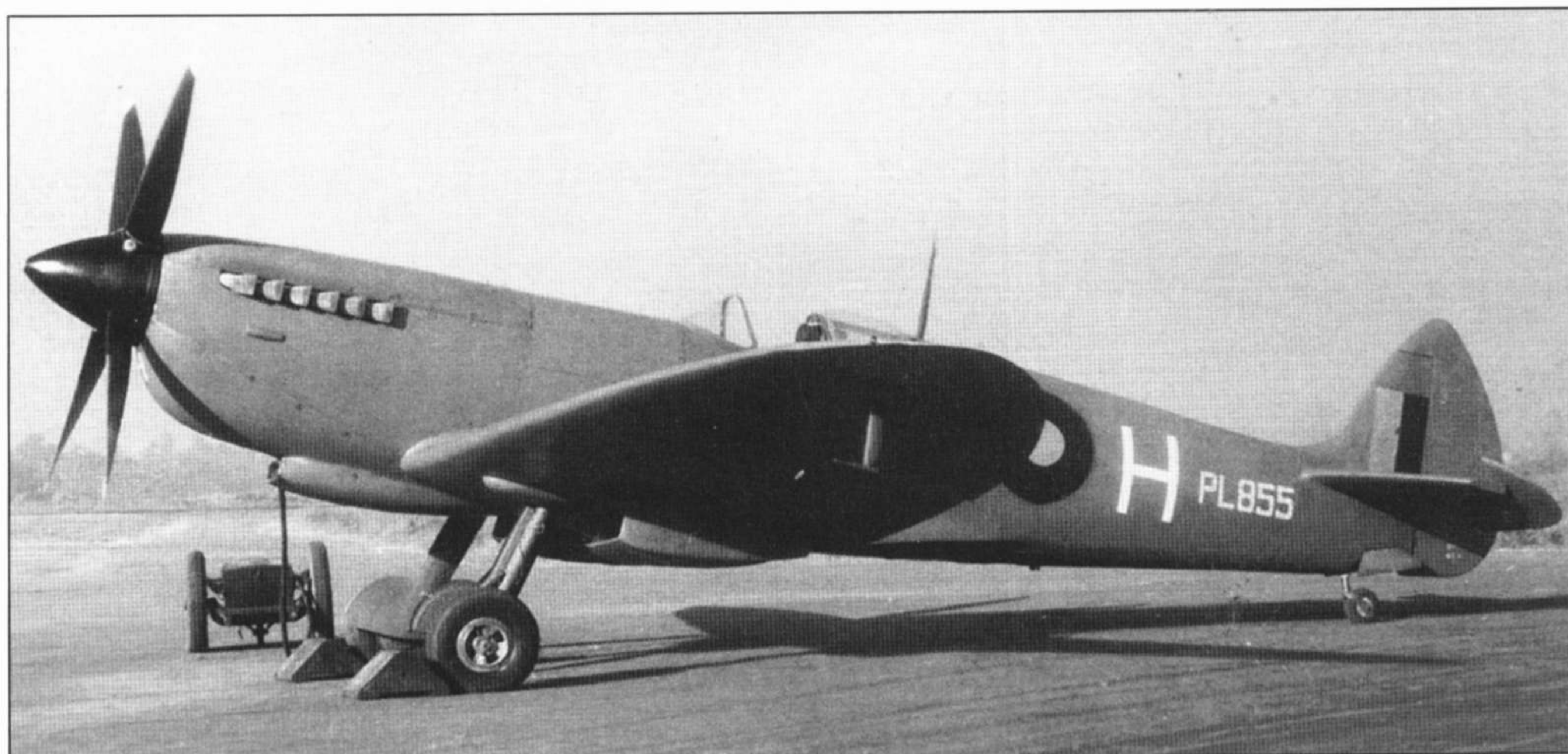
Spitfire PR.XI PA935 of 681 Sqn in India. Note the standard (small sized) SEAC roundels in Dull Ident. Blue and mixed light blue. (via P.Arnold)



under my tail and then away onto the horizon and then back again, left and right. I climbed up as hard as possible to 39,000 feet, but as he never opened fire I had no need to start turning, and eventually he flew away. This was the first Arado any of us had seen, and I think he must have been either on a training flight or himself on an unarmed PR mission. I felt quite confident that the XI could out-maneuvre him, if necessary. Being in a XIX on this occasion would not have helped in any way.'

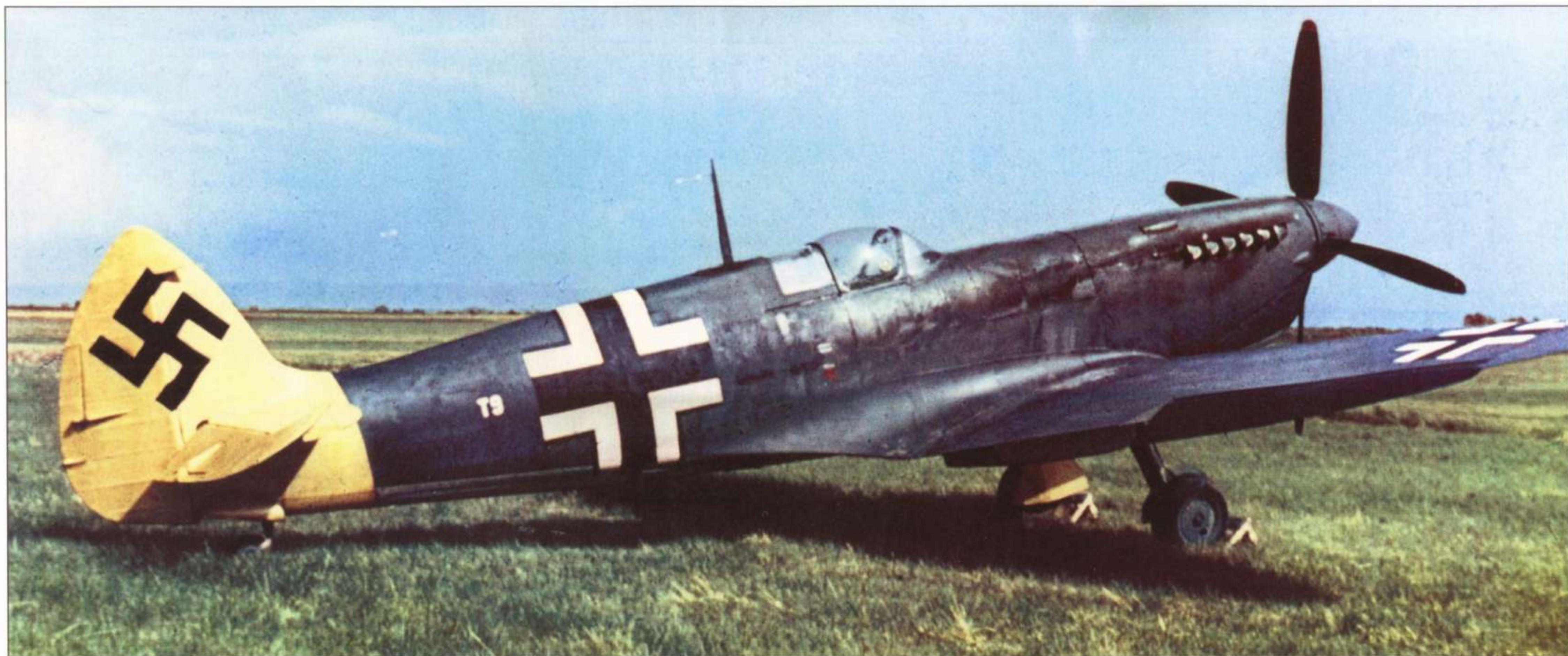
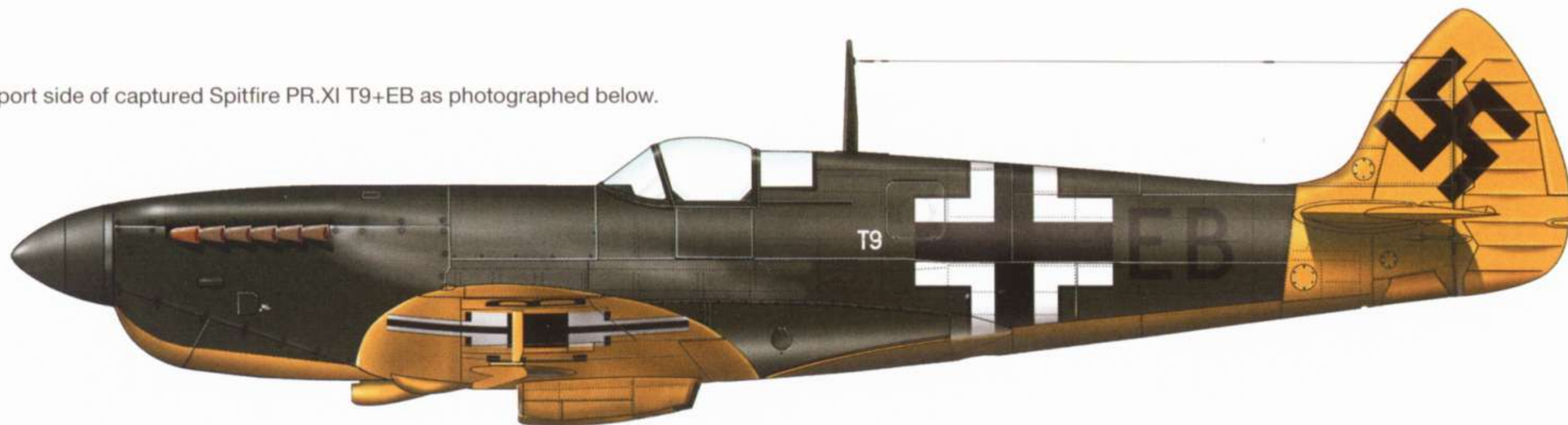


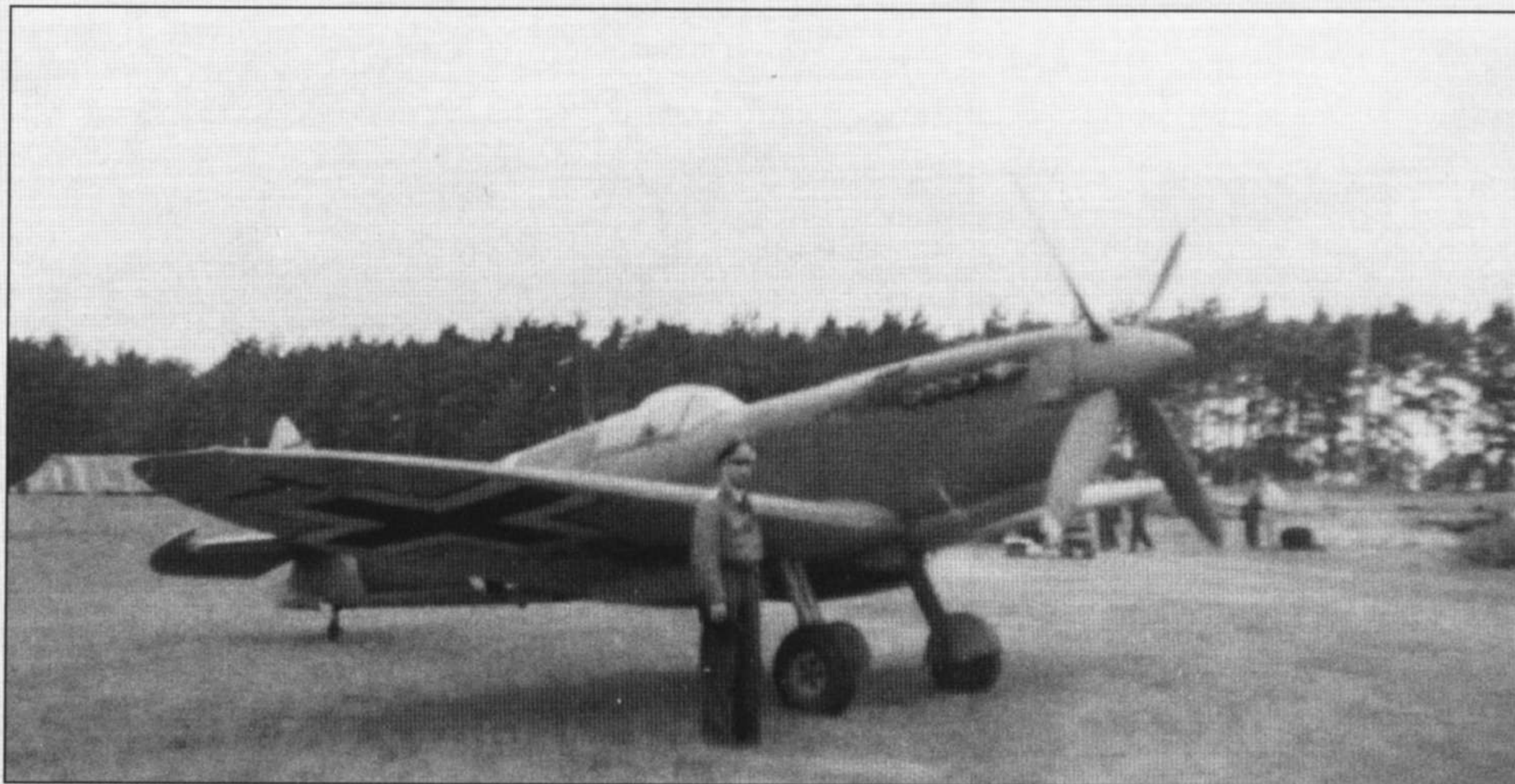
Ground crew members of 'A' Flight, 681 Sqn, with Spitfire PR.XI 'F' (possibly PL781) in late 1944 or 1945. Note the typical SEAC markings: small size roundels on the fuselage and wing, and the white or pale blue band across the wing. (Jack Gabbutt archive)



PL855 in India, 1944. Note the SEAC roundels with light blue replacing the European Theatre red centres, but the roundels have been left in the larger European size. ('Brick' Bradford via P.Arnold)

The port side of captured Spitfire PR.XI T9+EB as photographed below.





Above and left. This Spitfire PR.XI was captured by the Germans and used in the Versuchsverband Oberkommando der Luftwaffe (Experimental Unit of the Luftwaffe HQ).

The 2 Staffel (2nd Flight) of this special Luftwaffe unit was also known as the Sonderkommando Rosarius (Rosarius Special Unit - from the name of the OC), and informally as the "Zirkus Rosarius" (Rosarius Circus) or "Wanderzirkus" (Wandering Circus). This was the Luftwaffe equivalent of 1426 (Enemy Aircraft) Flight RAF, its role being that of displaying captured Allied aircraft to personnel of regular German Luftwaffe units. Curiously however, the 2 Staffel of any Luftwaffe unit was identified by the letter "K" as the last character of the code. The letter "B", seen in the colour photo on page 48, as the last of four characters was associated with the Gruppenstab (Group HQ). Records show at least two other captured aircraft (a Mosquito and a P-38 Lightning) flew with these T9+_B codes in 1944. There is also reference to a Spitfire coded T9+ER which seems a mis-spelling ("R" would indicate 7. Staffel of III Gruppe which never existed in this unit) and could be either T9+EB or T9+EK.

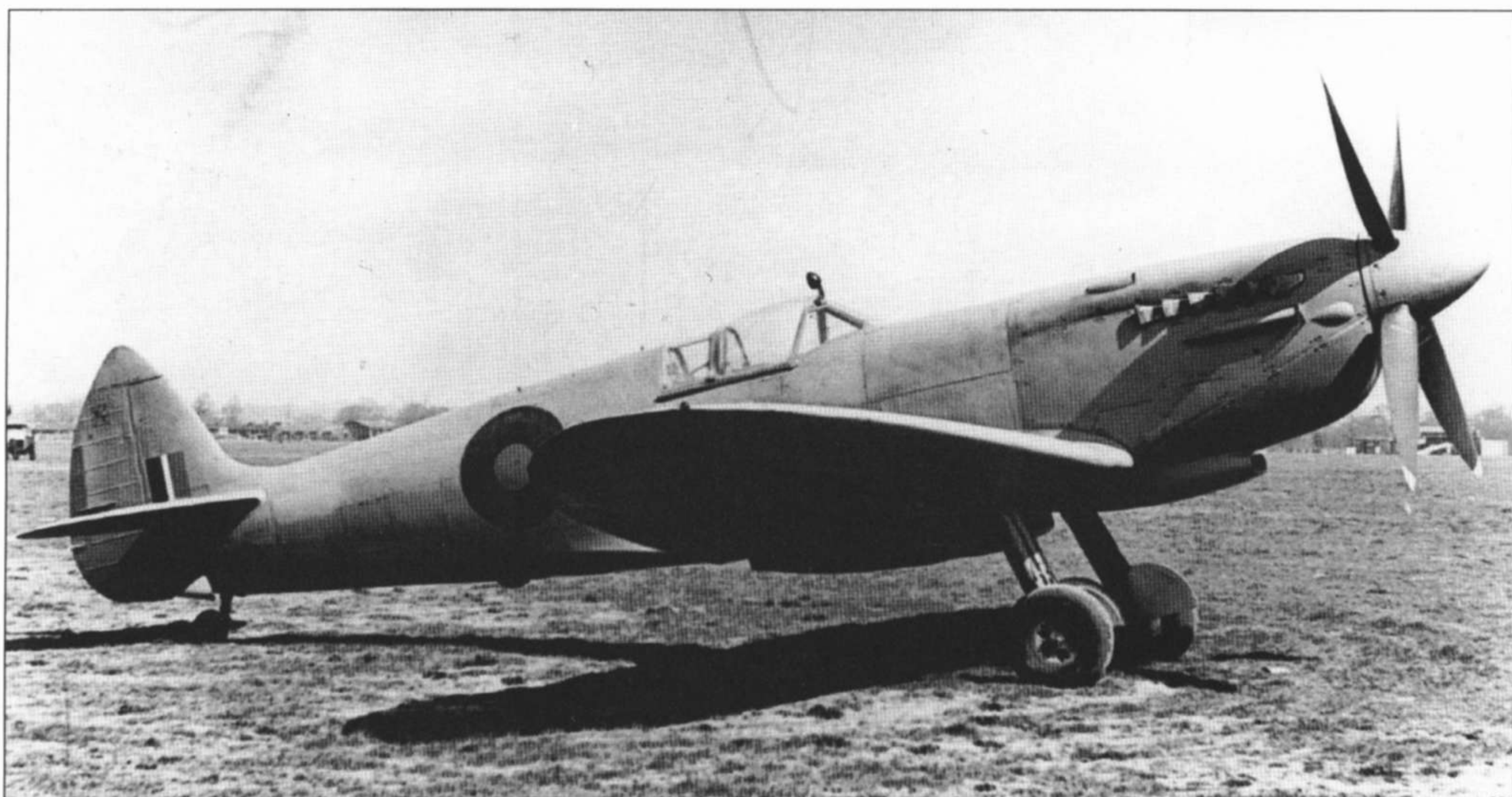
The photo on page 48 was apparently taken at Sagan-Küpper airfield (now Zagan-Kopernia in Poland), an advanced training base, in July 1944. By then the Spitfire had been completely repainted by the Germans, probably with Schwarzgrün ('black green') on top and sides, with yellow under surfaces and tail. The unit code 'T9' was applied (quite typically) in small white characters, while the aircraft code seems to have been in gloss black. The codes merge in with the camouflage, but the black letters look more like "EB" than "BB" or "EK", as usually captioned (although certainly not "EK", the code could be "BB", assuming that each character was applied in a different style).

Features of particular interest include the wire aerial, and the small red circle marking with white stencilled instructions on the side of the fuselage, below the cockpit (at the bottom corner of the "B").

The HF waveband wire aerial extends from the standard mast (aft of the cockpit) to a makeshift attachment at the top of the fin (not on top of the rudder as it was in aircraft with British HF radios!). Clearly, the original radio must have been replaced with a German HF set. The red circle symbol was used as standard on German aircraft to identify the ground electric supply socket. Its presence seems to indicate that the aeroplane was considered operational Luftwaffe equipment, to be used and serviced along with other types. Had it been retained as an experimental machine at a test centre, there would be no need to modify the electrical system. Normally, a Spitfire would have the ground socket in the port wing root fillet, and used 12V as standard. The Germans preferred 24V.

Interestingly, the colour of the main wheel hub looks like a pale blueish grey hue. Possibly it is in RAF PRU Blue (if originally from this Spitfire) or Medium Sea Grey (if replacement item from another Spitfire).

The identity of the Spitfire is still a mystery. Authors mention two PR.XIs serving with the Cirkus Rosarius: T9+BB and T9+EK. Known photos show that the EK was applied on top of an overpainted earlier code, so both could well be one and the same machine. According to the respected "Spitfire International", T9+EK was EN685, lost by the RAF in May 1944. Although a fairly early machine, the Spitfire may have been retro-fitted with pointed rudder (as featured in our photos) by that time. On the other hand, this type of rudder had been fitted to Mk XII fighters since 1943, and could be a replacement item while in captivity (especially as some German documents caption this particular Spitfire as a Mk XII!).



PR.X – THE HIGH FLYER

In the late spring of 1942, in parallel with the PR.XI, work was started at Supermarine on the Spitfire PR.X (type 362) project which featured a pressurised cockpit, based on that of the F.VII. It was planned at that time, that this would become the main PR variant. However, like many times in Spitfire history, before the carefully developed, state-of-the-art model was available, a version prepared rather hastily found widespread use. Lacking the sophisticated cockpit pressurising system, the Spitfire PR.XI was widely used from 1943 on and proved the highest flying and fastest aircraft over Europe. Even if German fighters approached the PR.XI at top speed none were

Above and below. Spitfire PR.X SR396 of 542 Sqn in the summer of 1944, probably at Benson. Although it has often been alleged that aircraft of this version were painted Medium Sea Grey overall, it is more likely that the scheme is the standard PRU Blue overall (compare photos of PR.XIs MB950 and PL830 on pages 35 and 42). Note how the serial has been obliterated by the censor. (via W. Matusiak)



able intercept it. Losses, which happened from time to time, were just unlucky. The PR.XI could fly at 27,500ft (8,400m) at a top speed of 422mph (680km/h). In an emergency it could climb to 44,000 ft (13,400m), while German fighters were only encountered below 42,000ft (12,800m). Humans cannot survive higher than 38,000ft (11,600m) for extended periods, which forced pilots to fly below that level and carefully watch their airspace; climbing for brief periods only, if enemy aircraft were spotted nearby. Flying above 36,000ft (11,000m), though possible, was also exhausting for the pilots because of the lower air pressure. During November 1943, out of 72 missions flown by 541 Squadron Spitfire PR.XIs no less than 30 were above 36,000ft. Fortunately, semi-pressurised pilot suits were introduced in February 1944 to 541 and 542 Squadrons and did help.



A representative array of recce Spitfires at a European airfield in 1945. Left to right; FR.XIV, PR.XIX, and PR.XI. (via P. Wisniewski)

In the quest for improved performance, more and more powerful engines were needed. 60-series Merlins marked the peak of this powerplant's development, so the next logical step was to use the significantly more potent Griffon, already employed in fighter Spitfire variants. However the new engine was only a partial solution. It would allow an increase in the top speed, rate of climb and ceiling – but what for? As mentioned, pilots of the Merlin-powered PR.XI were unable to use the full potential of their aircraft, because of the limitations of the human body. In order to allow the new PR.XIX to fly at altitudes it was capable of, a pressurised cockpit was necessary.

An old engineering rule is that one should not try several new solutions in one prototype. That was why Supermarine designers preferred to have short batches of two experimental recce Spitfires; PR.X (type 387) and PR.XIX (type 389). The PR.X was essentially a cockpit-pressurised PR.XI. This provided direct comparison with the un-pressurised variant. The PR.XIX was a combination of PR.XI wings and photographic system, plus the Griffon power-plant. Small batches of both the PR.X and PR.XIX were built during April-May 1944.

The PR.X (type 387) was similar to the standard PR.XI, but with a pressurised cockpit system essentially the same as that of the Spitfire F.VII fighter. As the whole cockpit structure had to withstand substantial pressure differentials the proven fighter-style windscreen, with built-in bullet-proof glass panel, was retained. Thus, the windscreen was the principal visual difference between the PR.X and PR.XI. Another characteristic feature was the long, thin intake on the starboard side of the engine cowling, which fed air to the cockpit pressurisation system.

Sixteen PR.Xs (MD191-199, MD213, SR395-400) were built during April and May 1944. The first of these - MD192 - arrived at Benson on 4 April 1944. Introduction of the type took about a month and the first mission was flown on 11 May, when 541 Squadron's MD193 was used to photograph French coastal fortifications. 542 Squadron's



Spitfire FR.IX MK716 'X'. This version was painted pale pink overall in 16 Sqn. They were used in the summer and autumn of 1944, so from the outset they wore only the lower half of invasion striping on the fuselage. The serial number MK716 and aircraft code 'X' were probably applied in Roundel Red on this machine. (H. J. S. *Jimmy* Taylor)



16 Sqn RAF Spitfires at A.12 Bayeux airfield in Normandy, autumn 1944. In the foreground is Spitfire FR.IX MK915 'V', painted pale pink overall. This machine is fitted with a 50 gallon torpedo tank. In the background are PR.XI aircraft in PRU Blue overall livery. All the aircraft feature invasion stripes on lower fuselage only, typical for the period. Aircraft letters seem to be applied in white on all the Spitfires, including the pale pink FR.IX. (H. J. S. *Jimmy* Taylor)



Servicing a fighter-reconnaissance Spitfire of 318 (Polish) Sqn that operated in the tactical reconnaissance role in the Mediterranean. Two F.24 cameras with 14" lenses and a Type 35 switch can be seen on the stand in the foreground, ready to be fitted in the Spitfire. The cameras were provided with adjustable mountings that could be pre-set to the required split angle (as seen here) and then each was inserted in its respective place, in the rear fuselage. (J B Cynk collection)

first mission was flown with MD198 on 24 May, over Bayeux. From June on, four-five PR.Xs were in use by each of the squadrons. They remained in 541 and 542 Squadrons until early 1945, when they were gradually replaced by the pressurised PR.XIXs.

As the PR.Xs did not enter wide-spread service or achieve great success, it is claimed by some authors that the type proved a failure, hence its limited production and use. Nothing could be further from the truth, however. Experience with the few PR.Xs, as well as with the early, unpressurised PR.XIXs (type 389), led to development of the eventual pressurised PR.XIX (type 390) which entered production in late 1944. Its pressure cockpit featured refinements resulting from PR.X experience. Notably, a new reinforced windscreen without fighter-style framing was developed.

PR SPITFIRES AND THE SPEED OF SOUND

At the end of 1943/1944 the Royal Aircraft Establishment at Farnborough commenced a high-subsonic flight test programme. The aim was to investigate aerodynamic phenomena occurring near the speed of sound and exceeding the critical Mach number. Mach number is the fractional value of an aeroplane's air speed divided by the speed of sound under the same conditions. As the speed of sound depends on air pressure (and hence, altitude), the same Mach number reflects different air speeds at different altitudes. The critical Mach number is the airspeed at which sound velocity is first attained anywhere on the aircraft (in aerodynamic flow the speed of air relative to an aircraft's surface varies considerably, and can reach much higher values than the airspeed of the aircraft as a whole). Testing was led by R. Smart, the Head of the High Speed Section of the Aerodynamics Flight Division, known as the Aero Flight.

The three fastest Allied aircraft were selected for these tests; the North American Mustang, the Republic Thunderbolt and the Spitfire. For this type of trial engine power was of secondary importance, as the machines would be dived from at least 30,000ft (10,000m) at an angle of 45°. Aerodynamic cleanness was more important, therefore



S/Ldr A F 'Marty' Martindale.
(RAE Farnborough)

Spitfire PR.XI EN409 minus its propeller and reduction gear, after the fateful Mach 0.9 dive by S/Ldr Martindale on 27 April 1944.

Note the aircraft was covered in a film of oil after its propeller spun off in the dive, which resulted in the apparent dark and shiny appearance.
(RAE Farnborough)



a Spitfire PR.XI was selected, in preference to a fighter version.

Initial trials proved that both American types were unable to attain any really high Mach numbers. The Mustang could only reach about Mach 0.8, while the Thunderbolt failed to get even close to that value. Therefore, the full trials programme was done with a Spitfire PR.XI (EN409). During the test flights three types of data were measured:

1. Change of drag and longitudinal balance that would be used later for verification of wind-tunnel trials.
2. Wing aerofoil drag.
3. Pressure distribution over the wing aerofoil.

Instead of a standard air pressure probe (pitot tube) under the port wing, EN409 had a special probe extending well forward of the wing tip, to avoid any mis-measurements due to airflow around the wing. A pitot array of 19 probes, located vertically one above another, spanning 14" (356mm) was mounted aft of the trailing edge, to measure pressure distribution in the wake of a single airfoil. At 98" (2.5m) from the longitudinal axis of the aircraft 1/16th inch (1.6mm) openings were made in the wing skin (ten each on the upper and lower surface) between the main spar and the trailing edge. These were used to measure surface pressures along one airfoil, to establish the extent of supersonic airflow over the wing. Another group of eight openings (four each on upper and lower surfaces) were drilled at 66" (168cm) from the longitudinal axis. A set of indicators was located aft of the cockpit in the camera compartment and these were photographed automatically at 1.5 second intervals, to provide a continuous record of their readings. The instruments included airspeed indicator, altimeter, transverse accelerometer, separate pressure indicators for each member of the pitot array and wing surface probes, elevator deflection indicator and engine controls. All these modifications had no noticeable effect on the Spitfire's flying characteristics.

Trials commenced in early 1944, initially with S/Ldr J. R. Tobin as the pilot. He was subsequently replaced by S/Ldr A. F. Martindale, OC Aero Flight. In February 1944 he achieved 606mph (975km/h) at 29,000ft (8,800m), equivalent to Mach 0.891. Even today this remains the highest Mach number ever recorded by a piston-engined aeroplane. On 27 April he made another attempt at pushing the Spitfire beyond Mach 0.9. At some 27,000ft an explosion and strong vibration rendered Martindale unconscious for a while. Eventually he realised his cockpit had filled with smoke and the windscreen

was completely covered in oil. Martindale had every right to bail out from the crippled Spitfire, but realising the value of the recorded measurements, he managed to glide back to Farnborough and land. It was found that the propeller and reduction gear had been torn away from the engine due to overspeeding. Incredibly, EN409 was repaired, and later used by 8 OTU until being written off in an accident, on 7 April 1945.

Following the accident, Martindale continued the trials in another PR.XI, PL827, delivered to Farnborough on 6 May 1944. This Spitfire featured a special Rotol propeller with full feathering option, to avoid a similar mishap in the future. On 15 August, during another high speed dive, the propeller constant-speed unit failed, resulting in supercharger failure and engine fire. Owing to cloud cover Martindale was unable to get back to Farnborough and attempted a forced landing at Whitmore Common, Surrey, crashing into trees. Despite a spinal injury, he recovered the measurement recording unit from the burning wreck, making it the second time he risked his life to save precious experimental records. His commitment earned him the Air Force Cross, the highest non-combat decoration in the RAF.

The measurements on Spitfire PR.XIs were used to describe compressibility effects at high subsonic speeds and the consequences of exceeding the critical Mach number. During a series of flights in excess of Mach 0.85 it was found that on the outer investigated profile (the instruments taking measurements 98in. from the fuselage axis) supersonic airflow covered over 50% of the chord. Under the same conditions the airflow over the inboard airfoil (66in. from the axis) was entirely subsonic. Results of the programme proved invaluable in developing the first generation jets for the RAF and FAA. Comparison of test results revealed serious inaccuracies in Britain's wind-tunnel tests and led to modification of the RAE supersonic wind-tunnel. Ironically, these test results also heralded the demise of the Supermarine Spiteful fighter, which had been intended as the Spitfire's successor. No operational piston-engine aeroplane would ever exceed the Spitfire in terms of high subsonic characteristics.

POST-WAR SERVICE



After the war Spitfire PR.XIs continued to be used by RAF units, in a variety of roles. They undertook a lot of survey flying, mainly in the Mediterranean, and operational flying was conducted during the Italian-Yugoslav dispute over the city of Trieste. PR.XIs were also used as fast courier aeroplanes delivering the mail, sometimes even by staff officers!

It was not only the RAF who used the Spitfires in this way; for example PL983 (registered as N74138) was used as an official aeroplane by Livingston Satterthwaite, the Civil Air Attaché to the US

Judging by the combination of snow plus C type roundels on the upper wings this line-up, including Spitfire PR.XIs, is in the winter of 1945/46. They are with the British component of the Allied Occupation forces in Germany. (via D Welch and P. Arnold)



A 1948 press cutting discussing Spitfire PR.XI, ex-PL983, that was registered as N74138 for the use of the Civil Air Attaché to the US Embassy in London. Not long after this PL983 was flown in air races by Lettice Curtis, who broke the women's national 100km closed-circuit record at 313.208 mph. This aircraft was later returned to Vickers who passed it on to the Shuttleworth Collection as G-15-109 in 1950. (via W. Matusiak)

ANGLO-U.S. CO-OPERATION.—It is gratifying to see that Mr. Livingston Satterthwaite, the American Civil Air Attaché in London, has chosen a Spitfire as his private mount. The aircraft, which is a Spitfire XI, powered by a Merlin 70, has been specially prepared for him by Supermarines.

The RAF St Albans web site reports that: On 4 June 2001 Martin Sargeant was killed instantly when PL983 crashed at an airshow near Rouen, France. A few minutes after taking off he reported an engine problem and was about to land on the designated emergency strip, parallel to the main runway. Sargeant had PL983 lined up for a textbook emergency landing when he saw people on the strip and called the tower to say he couldn't land there. As he turned, presumably attempting to re-align on the hard runway, the Spitfire apparently stalled and hit the ground inverted, exploding on impact. Visitors to the show said that there were placards spaced along the length of the emergency runway, instructing the crowd it was active and must not be crossed.



Embassy in London. In 1947 he even allowed Lettice Curtiss to set the 100 km closed-circuit world speed record, at 313.208mph (503.95 km/h), in this Spitfire.

Some PR.XIs were also used after the war by RAF training establishments. The variant was officially declared surplus to requirements by the RAF in February 1948. However, several other countries acquired Merlin-engine PR Spitfires after the war.

Two PR.XIs of the Mediterranean and Middle East Communications Squadron (MMECS; apparently of 'C' Flight) at Heliopolis in 1946. PL915, in the foreground, would be written off following an accident at Heliopolis on 16 September that year. The engine lost power during landing and the aeroplane's wing hit the ground. Note that the aircraft has been stripped to bare metal, with a dark finish in front of the cockpit (antiglare panel) and on the forward portion of the wing. The latter is rather unusual as it would result in the fuel tanks heating more than if they were left in natural metal! It is not impossible, though, that both this and the dark patch on the top of the rear fuselage have been painted in a conspicuous tone (such as bright red) to aid location in case of emergency landing in a desert area. The Spitfire wears 'C'-type roundels and the regulation large black serial on wing under surface. Interestingly, the other PR.XI seems to have been left in her extremely faded PRU Blue, and shows no underwing serial.



A Spitfire PR.XI, India post war, with a similar finish to PL915 above. Its serial appears to be PA907, an ex-681 Sqn machine used by No. 216 Group Communications Flight. There seems to be a small piece of nose art on the fuselage, just forward of the windscreen. (via P Arnold)



ARGENTINA

In 1947 one PR.XI (PL972) was purchased by Argentine-born RAF officer, James Storey for civilian survey use in Argentina, and registered LV-NMZ in that country. By July 1948 the Spitfire was taken over by Fuerza Aerea Argentina (although, apparently, not officially taken on charge). In November 1951 PL972 was damaged in a landing accident, and was subsequently scrapped.

Spitfire PR.XI registered LV-NMZ, was owned by James Storey who operated it as part of his aerial photography business in Argentina. This Spitfire was purchased by Supermarine from the Ministry of Supply and refurbished for Storey. It was non-standard in some detail, such as having PR.XIX-style 19.25 gallon wing tanks aft of the main spar, in addition to the RAF version's 'wet' wing which held 133 gallons.

Leaving England on 29 April 1947, Storey flew the Spitfire from Hurn to Buenos Aires, via Gibraltar, Dakar, Natal, Rio de Janeiro and Montevideo. For the trans-Atlantic portion of the journey, from Natal to Rio de Janeiro on 5 May, he was accompanied by a BSAA (British South American Airways) Avro York G-AHFH. (NASM)



Comparison between this photo and the one at the top gives a clear indication of how much PRU Blue varies in black and white photos! (Ricardo Lezon)



After Spitfire PL972 was taken over by the Argentine air force, it was assigned to Instituto Aeronautico, and received dark green camouflage on upper surfaces, with blue undersides, and Argentine national markings. (Ricardo Lezon)



Royal Danish Air Force Spitfire PR XI, 42-451 in PRU Blue. (RDAF via Kenneth Øhlenschläger Buhl)

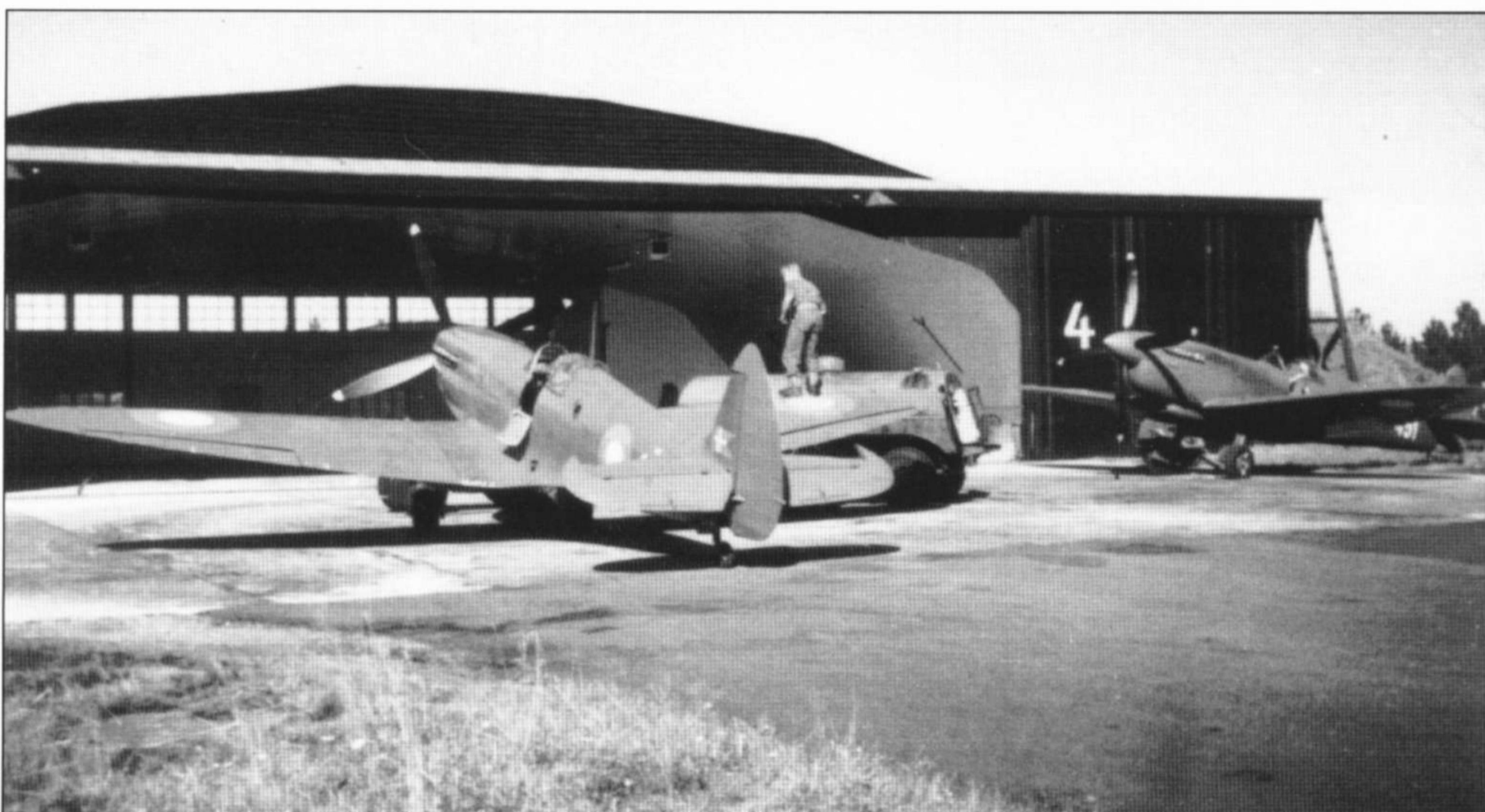
DENMARK

Denmark purchased three Spitfire PR.XIs in 1947; PL794 (renumbered 42-451), PL833 (42-452), and PM134 (42-453). They were initially used by the *Spitfireskolan* (Spitfire school) and then by *II Luftflotille Søvaernets Flyvevaesen* (2nd Flotilla of the Naval Aviation), and then the *4 Eskadrille Haerens Flyvertropper* (4 Squadron, Army Aviation). When Denmark formed the separate *Det Kongelige Danske Flyvevæben* (Royal Danish Air Force) on 1 October 1950 they were used by *Eskadrille 722* until leaving service on 1 June 1955.

Danish colours and markings

When first delivered the Danish PR.XIs carried RAF style serials in black. Danish roundels were painted directly over the RAF roundels to the same sizes and fin flags were applied. Later the PR XIs were incorporated into Denmark's national numbering system, with Spitfire IXs being type 41 and PR XIs type 42. Roundels and flags were moved to new locations and sizes revised as per our colour illustrations on page 44. The new style of serial were white. These changes took place at about the time Denmark amalgamated its Army and Navy air branches to become the Royal Danish Air Force, in 1950.

This Royal Danish Air Force Spitfire PR XI, 42-453 appears to be newly painted in PRU Blue overall including spinner. The propeller blades were black with yellow tips. (RDAF via Kenneth Øhlenschläger Buhl)



FRENCH INDOCHINA

Apparently a single PR.XI from RAF SEAC stock was handed over to the French, in Indochina.

GREECE

Greece acquired one Spitfire PR.XI, EN656, in May 1947. Apparently they also purchased three PR.XIIIs, but there seems to be confusion here, as their serial numbers (as quoted in Greek records) were in fact... Wellington GR.XIIIs!

INDIA

India took over several PR.XIs that were ex-681 Sqn RAF stock (known serial numbers include MB909, MB910, PA862, PA896, PA898, PA906, PA908, PA934, PL768, PL780, PL784, PL889, PL898, PL907, PL951, PL960, PL988, PL997). They were used by 101 Flight of the Royal Indian Air Force (later simply Indian Air Force). Their subsequent fates are obscure, except that PA908 was later used as a ground instructional airframe.

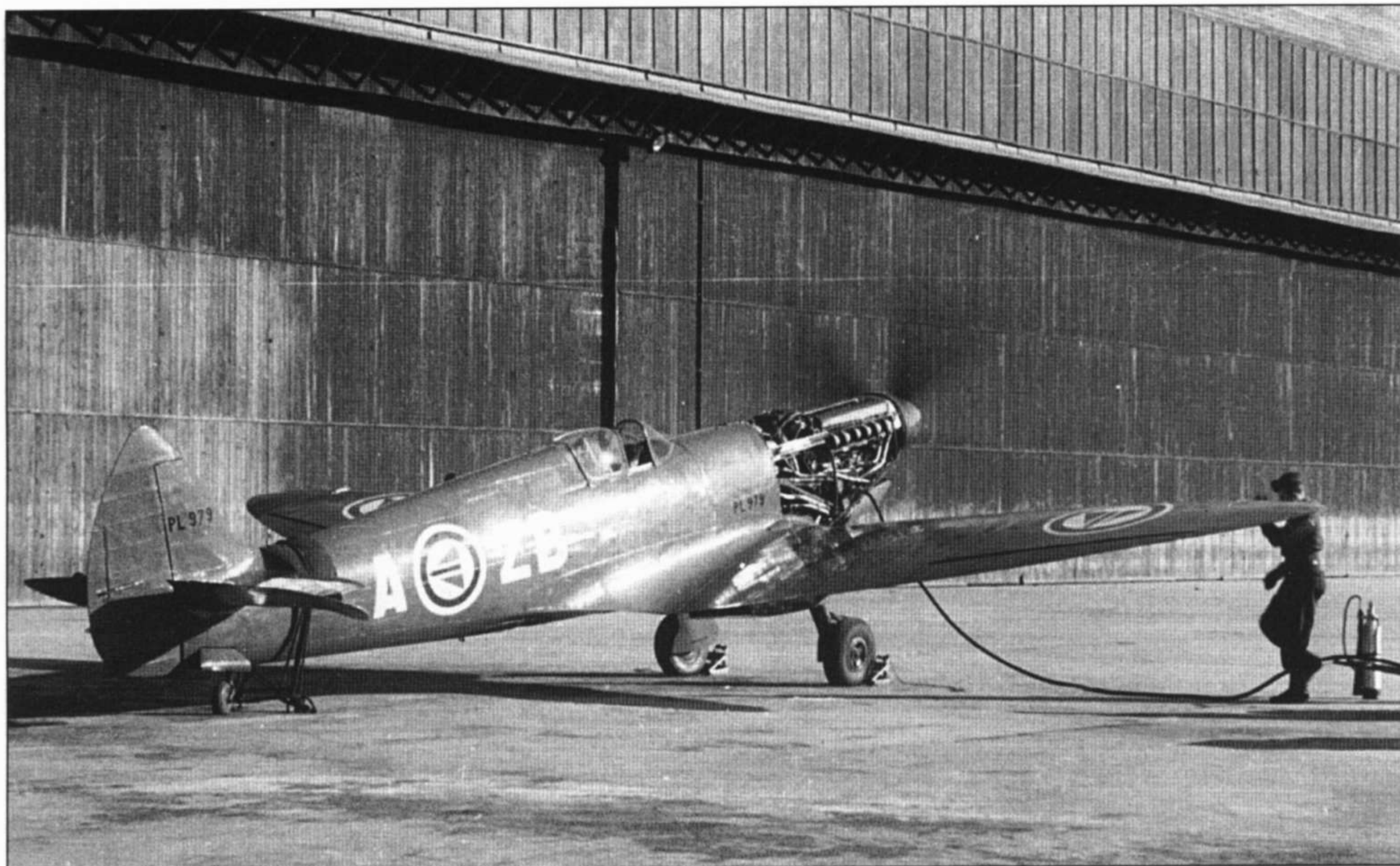
ISRAEL

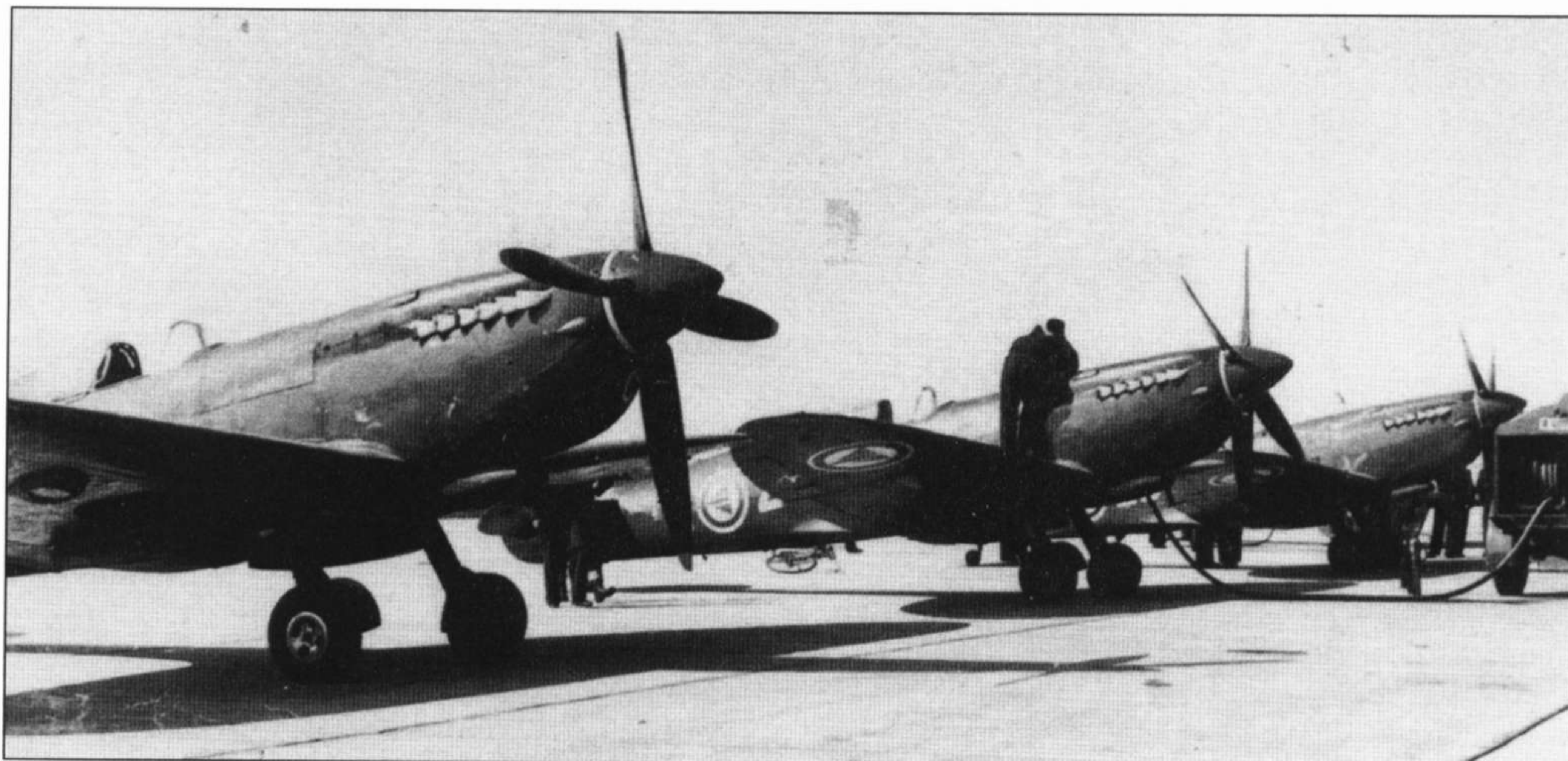
Substantial components of Spitfire PR.XI EN661, previously used by RAF's Air HQ Levant Communications Flight, were used by members of the fledgeling Israeli air force when they assembled the first serviceable Spitfire of the service. EN661 had originally been the first PR.XI in the Middle East, delivered to 680 Sqn in mid-August 1943.

NETHERLANDS

Four static Spitfire PR.XIs (PL912, PL965, PL998, PM133) were delivered to the Netherlands School of Technical Training for instructional purposes.

Norwegian PR.XI PL979 'A-ZB' having its engine run-up at Sola air base, near Stavanger, in the early 1950s. This PR.XI flew the RDAF's last Spitfire sortie in late March 1954. (S. Meum)





NORWAY

In 1947 Norway purchased three PR.XIs. They were used by the *Nr 1 Fotorekognoseringsving* (1 PR Wing) after a two year refurbishment programme, from 1949 until March 1954.

The RNoAF also considered converting some of their Mk IX fighters for PR duties. They intended to remove the cannon and replace them with additional fuel tanks. Photographic installation options would be similar to those of the PR.XI. In the end the ideas were not used and stayed on paper. At the same time Egypt showed interest in six to ten Mk IX aircraft, modified along the same lines. Nothing is known of the conversions.

The three Norwegian PR.XIs. Left to right; PL994 A-ZC, PL861 A-ZA, and PL979 A-ZB. Note the blister fairing of the wing-mounted F.8 camera with short focal length, visible in the foreground. (via W. Matusiak)



PL861 A-ZA after the accident on 24 March 1954. When coming in to land at Kjevik, Loytnant Jens Width (acting OC of the PR Wing RNoAF) struck a pile of snow with the port main wheel and the entire leg broke off. He then retracted the starboard leg and made a textbook belly landing. (via S. Watson)

Post war Norwegian Numbering System

The RAF coding style (squadron code and individual letter) was phased out in 1946 and replaced by a system consisted of a single letter identifying the aircraft type followed by a two letter combination identifying the individual aircraft. This three letter set was to follow an aircraft throughout its entire service life. There was to be no Squadron specific code letters on any aircraft.

For example, the letter 'A' was assigned to Spitfires, 'B' to Vampires and 'F' to Mosquitoes. This letter was placed to the left of the fuselage roundel and the two letters identifying the individual aircraft, to the right. The two letter combination had the additional provision that 'AA' was not used and neither were the letters J and Q, hence Spitfires began with 'AB'. When the 'AB' to 'AZ' sequence was exhausted the series would continue with 'BA', 'BB' and so forth.

The markings were now standardised in size. The roundels were 90cm on the wings and 60cm on the fuselage and the codes were 50cm high. This individual aircraft type coding system was short-lived. It was unpopular with RNoAF personnel who felt that the 'esprit de corps' was lost with the removal of squadron codes.

A note about Norwegian Mk IX fighters

In 1951 the old RAF system was partly reintroduced for combat aircraft. Non-combat types, such as the photo-Spits, retaining the aircraft based code system. All Spitfire F.IXs were recamouflaged with the pattern differing from the original British specifications. The Mk IXs were painted in green and grey upper surfaces with light grey undersides. Their squadron code was now in 60cm high white letters, positioned to the rear of the roundel on each side of the fuselage, with the individual letter to the front. 8" (20cm) high serial numbers re-appeared on the rear fuselage and a 5cm wide white outline was added to all roundels. Also, some aircraft had yellow wing leading edge strips added.

Norwegian PR Mk XIs

Sub-variants of a type not performing a combat role, such as those used for photographic reconnaissance, were to have individual codes commencing with 'Z', hence the three PR Spitfires operated were coded 'A-ZA', 'A-ZB' and 'A-ZC'. Their previous British serial numbers were PL861, PL979 and PL994 respectively.

No 1 Photographic Wing retained this system until RNoAF Squadrons were integrated into NATO. The Wing, then operating Republic F-84E



Norwegian PR.XIs 'A-ZA' and 'A-ZC' at Kjevik air base, on one of the many detachments performed by these machines. Note that 'A-ZA' has teardrop side blisters on its canopy, the only Norwegian PR.XI to have them. As 'A-ZC' was destroyed in a crash in August 1953, this picture must date from before that time. (S. Meum)



Thunderjets, not being of WWII vintage eventually gained squadron status and received the squadron code letters, 'AZ'.

Colour Schemes

When the RNoAF got its PR.XIs from RAF stocks they were finished in the standard RAF scheme of *PRU Blue*, overall. The RAF roundels were replaced with Norwegian ones. However, the aircraft then spent two years in storage before being refurbished and put into service.

During this refurbishment process the three Mk XIs were repainted in a darker, bluer paint of Norwegian manufacture. The colour was similar to FS25053, or a mix of Xtracolor X30 and X123 50/50 for modellers. The spinner backing plates were painted silver (not white as is often reported). The serial numbers were black and placed forward of the cockpit, as per our illustrations. Unfortunately the serials were black, on a dark blue background, making them barely visible on black and white photos.

The only remaining Norwegian Spitfire PR.XI (in the Gardermoen Aircraft Museum) is in this scheme.

TURKEY

Turkey used three PR Spitfires referred to in their documents as the "Mk V(PR)" (serialled 5801-03 in Turkish records). These seem to have included at least two PR.IVs (BP882, BR644), lost in 1943 by 680 Sqn RAF, in unspecified circumstances in the eastern Mediterranean. Turkey is sometimes said to have used a single PR.XI (no. 5851), but the serial quoted usually in this context (MK915) was, in fact an FR.IX conversion of a standard LF.IX fighter, (which actually was no. 6347 in Turkish service). Reconnaissance Spitfires (also including PR.XIXs) served with the Yusek Irtibat Kesif Foto Kitaati (Communication and Photo Reconnaissance Unit of the High Command) until 1948, then with 3 Bölük, 10 Kesif Alayı (3rd Company, 10th Reconnaissance Regiment) at Afyon, and from 1951 till 1954, with 4 Hava üssü (4th Air Base) at Merzifon.

Today a number of PR Spitfires are held in private and national collections around the world, several of them are kept airworthy.

Spitfire PR.XI PL993 TOC-D of No.1 Officers' Advanced Training School at Digby in 1946 or 1947. The fuselage roundel is rather unusual in size and proportions. The finish appears to be PRU Blue overall with white spinner and codes, and the serial most likely Medium Sea Grey. The photograph was taken using film/filter combination, which has blended the roundel's yellow outer ring with the camouflage and rendered red much darker than blue. (W. Matusiak)

Appendix 1. Camouflage colour guide

This is a list of the paints used on PR Spitfires. *Italics* denote the colours developed in PR units, not included in British standards. The US Federal Standard FS 595a equivalents should be regarded only as approximates, even though I did my best to pick them as close as possible, using paint samples or credible sources of information. Be aware that the same shade could be known by different names, depending whether the paint was matt, semi-glossy or glossy. The majority of the paints given below were matt; according to the FS 595, a matt paint nos. begin with 3, semi-glossy with 2, and glossy with 1. Doubtful cases are marked with a question mark. In some cases nothing more than the colour name is known. Regarding the standardised colours, I have added my own description of the shade to their sometimes colourful names.

Aircraft Grey Green (semi-glossy), primer paint, for aircraft interior	24172
<i>Camotint Blue-Grey</i> (later standardized as the PRU Blue)	?
<i>Camotint Green</i> (one of the shades from the family of Sky/Eau-de-Nil/Pale Blue/Sky Blue)	34533?
Dark Earth (dark brown)	30118
Dark Green (dark olive-grey)	34079

Dark Mediterranean Blue (dark navy blue)	35050
Dark Sea Grey (dark neutral grey)	36118
Dark Slate Grey (dark greenish grey)	34096?
Deep Sky (dark blue)	35102
Eau-de-Nil (Water of the Nile - light grey with greenish hue, glossy)	14533
<i>Extra Dark Blue-Grey Camotint</i>	?
Extra Dark Sea Grey (very dark neutral grey)	36099
Extra Dark Sea Green	34092
Identification Red, Dull (markings, codes and serials)	30109
<i>Light Blue-Grey Camotint</i>	?
Light Slate Grey (light greenish-grey)	34159
Medium Sea Grey (neutral grey)	36270
Night (more-or-less black, codes and serials)	37038
Ocean Grey (bluish-grey)	36104
Pale Green (similar to Eau-de-Nil but semi-gloss, primer used for aircraft interior)	24533
PRU Blue (dark blue-grey)	35189
<i>PRU Mauve</i> (dark mauve-grey) no match in the FS 595a, the best approximation is a mixture of about 50:50 of 36118 and 37144	
Royal Blue (very dark gloss blue, almost black)	15044
Sky (light grey with greenish-blue hue, more grey than Eau-de-Nil)	34424
Sky Blue (light grey with bluish hue)	34325

Appendix 2. Spitfire PR.XIII serials

Examples of the conversions-from-conversions policy within early generation PR Spitfires:

ex-Mk VB, 4 machine guns (17 aircraft): P8784, W3135, W3831, AA739, AD354, AD389, AD501, AD556, AR319, BL378, BL446, BL526, BM350, BM447, BM591, EN902, EP229

ex-Mk VA, 8 machine guns (1 aircraft): W3112

ex-Mk VA, ex-ex-Mk IA, 8 machine guns (3 aircraft): L1004 (later converted to Seafire III), X4615, X4660

ex-Mk VB, ex-ex-Mk IIA, 4 machine guns (1 aircraft): P7505

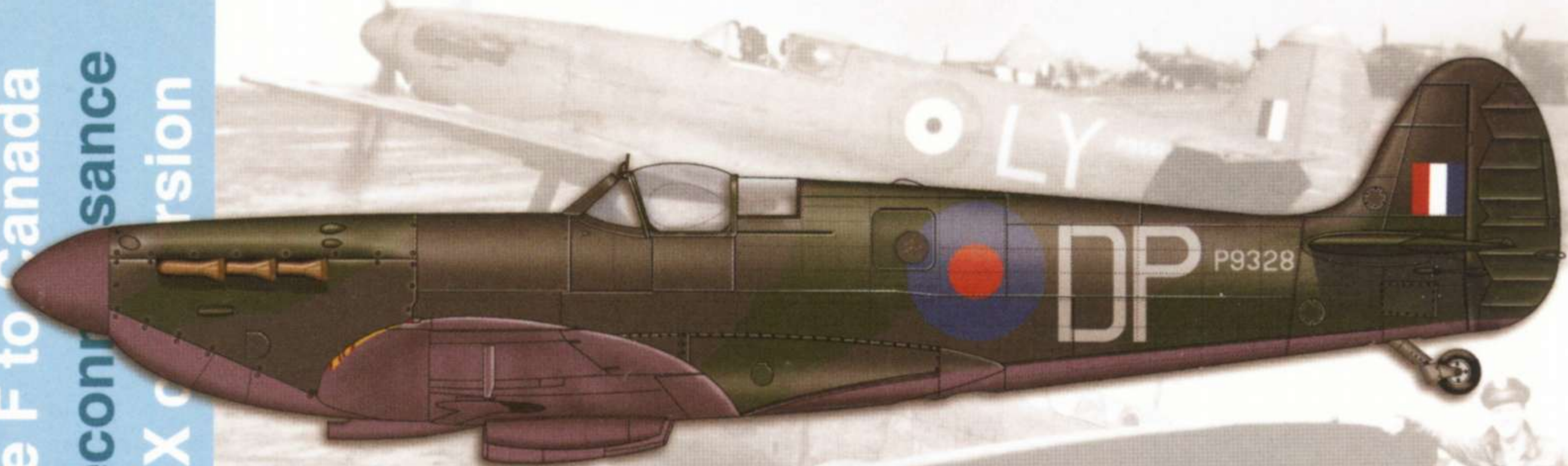
ex-PR.VII/type G, ex-ex-Mk VA, 8 machine guns (2 aircraft): R7308, R7335

ex-PR.VII/type G, ex-ex-Mk VA, ex-ex-ex-Mk IA, 8 machine guns (2 aircraft): X4021, X4766

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PRU Mauve PR Spitfire type A Photogenic Virgin Soviet Air Force
PR Spitfire type D J 20 The Cott Club Camorint type F to Canada
Battle of France Farm de-a wing valve strategic reconnaissance
Extra a Gre kIV Darid PR.IX conversion



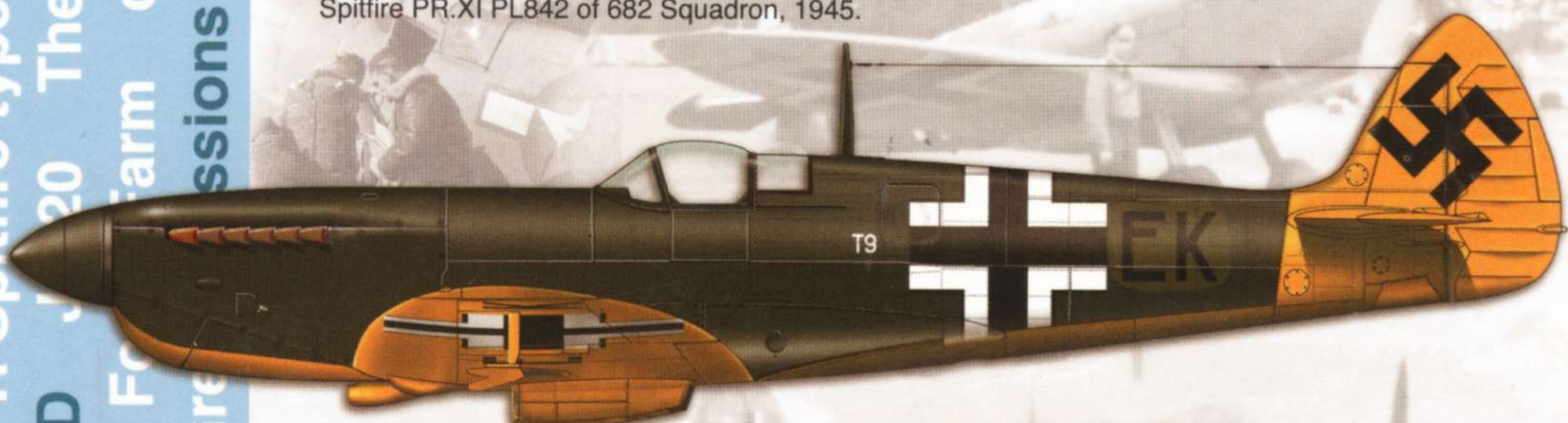
A Spitfire PR type G of 1416 Army Co-Operation Flight, 1941.



A white Spitfire PR type G (PR.VII).



Spitfire PR.XI PL842 of 682 Squadron, 1945.



Captured Spitfire PR.XI T9+EK.



A PR.IV in the overall Royal Blue scheme, typical for the Mediterranean.